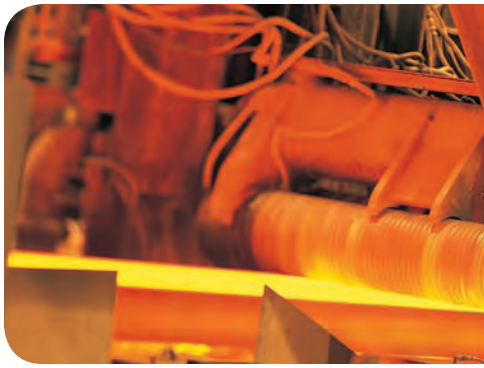
CENTERLINE® 2100 Motor Control Centers Selection Guide

Allen-Bradley

Industry-Leading Motor Control Centers Delivering
Safety, Performance and Reliability



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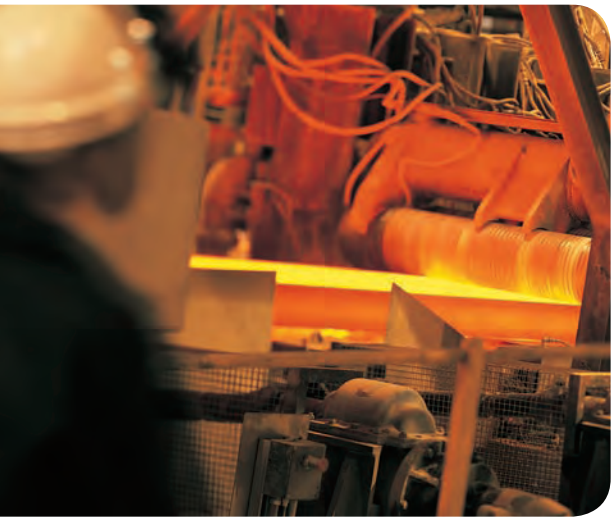
CENTERLINE® 2100 Motor Control Centers

Selection Guide



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Product Overview

Industry-Leading Motor Control Centers Delivering Safety, Performance and Reliability

The CENTERLINE 2100 Motor Control Center (MCC) combines rugged durability and premium quality, meeting UL and NEMA standards. CENTERLINE 2100 MCCs integrate control and power in one centralized package with a wide variety of motor control options. This industry-leading motor control center has delivered the safety, performance and reliability you need for over 35 years.

- Designs are certified to UL 845 and meet NEMA standards
- Built-in DeviceNet with IntelliCENTER technology
- Helps to reduce arc flash hazards with ArcShield
- Consistent design allows for backward compatibility
- Proven CENTERLINE bus design for improved heat dissipation
- Solid grounding system to help reduce shock hazards
- Fully isolated enclosures for maximum fault containment
- Space saving designs maximize section use reducing your MCC footprint
- Variety of intelligent motor control options
  - Across-the-line starters
  - Soft starters
  - Variable speed drives

The CENTERLINE 2100 MCC uses proven technology for high quality and years of dependable service.

- High short circuit withstand ratings in type-tested enclosures
- Continuous bus bracing provides uniform support
- Durable NEMA components
- Factory tested for faster and more dependable start-up
- CENTERLINE 2100 MCCs with IntelliCENTER Technology have built-in networking and preconfigured software to:
  - Enhance performance through system-wide communications
  - Share diagnostic information for predictive maintenance
  - Initiate warnings before potential faults occur

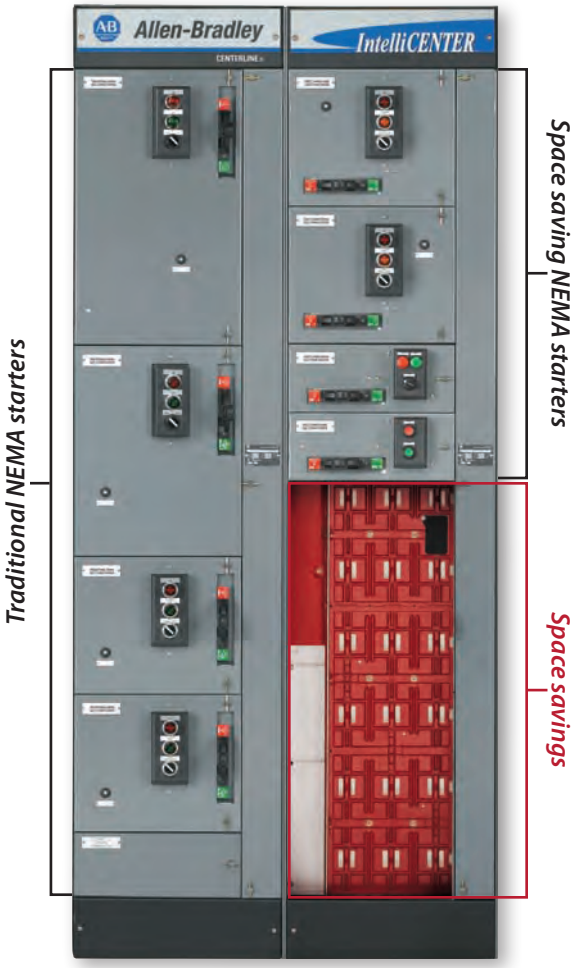
With more intelligent components and more options than other MCC manufacturers, you can get a complete power, control and information solution packaged per your local specifications, built on a common platform.

The CENTERLINE 2100 MCC is ideal for customers who want to leverage the same architecture, components, programming language and networking, regardless of where you do business all while knowing you will receive unparalleled support from a single-source provider.

Space Saving Units

With limited floor space in your facility for motor control equipment, space saving units can help reduce your section count and save valuable floor space. Space saving unit designs for CENTERLINE 2100 MCCs are available for Size 1-5 full voltage non-reversing and Size 1-3 full voltage reversing starter units, feeder units, drive units and soft starter units. Space saving designs provide an alternative to traditional units and can significantly reduce the overall footprint of your CENTERLINE 2100 MCCs while still meeting NEMA and UL standards.

CENTERLINE 2100 MCC space saving units can be used for applications such as commercial, water, wastewater, off-shore oil platforms or when minimizing your MCC footprint is critical.



Space savings shown from when equivalent space saving NEMA starters are used instead of traditional NEMA starters

IntelliCENTER® Technology

CENTERLINE Motor Control Centers (MCCs) with IntelliCENTER technology use intelligent motor controls, built-in networking and pre-configured and tested software to enhance performance through system-wide communications that share diagnostic information for predictive maintenance and initiate warnings before potential faults occur. Built-in networking captures information for predictive maintenance, process monitoring and advanced diagnostics enhancing the intelligence of a CENTERLINE 2100 MCC.

IntelliCENTER technology features built-in DeviceNet™, intelligent motor controls and advanced monitoring software all preconfigured and tested at the factory. CENTERLINE MCCs with IntelliCENTER technology are a cost effective solution to solve even your most complex motor control needs.

Intelligent Motor Controls

CENTERLINE Motor Control Centers (MCCs) with IntelliCENTER Technology combine intelligent motor control and protection devices with advanced networking and diagnostic capabilities to give you an inside look at your motor control application.

"With its 'plug-and-play' setup, IntelliCENTER Technology reduces installation time and minimizes facility downtime. It is able to quickly start delivering intelligent diagnostic and predictive failure information."

Daewoo Shipbuilding Marine Engineering – South Korea

Built-in Network

Your startup is faster with built-in DeviceNet cabling because complex interwiring is reduced to a single DeviceNet cable. The preconfigured and validated DeviceNet network reduces your need to make device connections, set baud rate or assign node addresses.

IntelliCENTER Software

The addition of IntelliCENTER software provides the ultimate window into your MCC. The software puts both real-time diagnostics and MCC documentation at your fingertips to maximize MCC and related equipment performance. Graphical views of individual MCC units display device data allowing you to quickly view critical status information.

IntelliCENTER technology reduces installation time with its plug-and-play setup and minimizes your downtime by quickly providing intelligent diagnostic and predictive failure information.

Increase Uptime with Advanced Maintenance Tools

The preconfigured software gives maintenance personnel easy access to critical CENTERLINE MCC configuration information and process data for troubleshooting. The configurable system views give you system status at a glance and can help keep facilities running with electronic documentation, remote diagnostics and predictive maintenance. IntelliCENTER Software allows you to significantly reduce HMI programming time and PLC development time with automatic tag generation and even complete network configuration before the MCC is powered up.

Enhance Personnel Safety

Enhance your personnel's safety with remote access to real-time data for monitoring, configuration and troubleshooting of intelligent motor control devices. IntelliCENTER software harnesses the power of the Integrated Architecture™ system so you can access critical MCC information from anywhere in your facility.

IntelliCENTER technology increases your access to information, minimizes maintenance and troubleshooting time with real-time motor control diagnostics and increases productivity with complete packaged and pre-engineered solutions for your most challenging applications.

"We receive an alarm in the main plant control room if amperage in one pump controller is too high, and we can go directly to the problem and fix it. In some instances, the system's predictive monitoring in the MCCs helps us address over-amperage problems before faulting."

Bob Moreno
City of Yuma, AZ – USA

Safety

The standard offering of the CENTERLINE 2100 MCC provides you with improved safety. CENTERLINE MCCs are designed to enhance operation and make it safer. No other MCC manufacturer offers the same protection for personnel and equipment

- High level of isolation from hazardous voltage
- Superior fault containment
- Solid grounding system

These safety features help protect employees and keep your process up and running

- Advanced diagnostics from IntelliCENTER software provide remote access to data and troubleshooting, minimizing your need to enter the arc flash boundary zone
- IntelliCENTER software allows you to troubleshoot your MCC remotely, without personal protective equipment (PPE)
- High degree of fault containment helps prevent a single fault from cascading throughout the enclosure, limiting equipment damage
- Isolation, grounding and remote monitoring help prevent accidental exposure to energized parts
- Automatic shutters isolate vertical bus when a unit is removed

- Continuous bus bracing provides more uniform support than point bracing
- Infrared windows allow completion of thermal inspection without opening doors, to minimize personnel entry in to the enclosure
- Plug-in replacement units allow maintenance to be performed away from energized controls
- Intelligent motor control devices warn of an impending failure before it occurs
- NEMA components help deliver dependable operation
- Locking and Interlocking features allow for easier implementation of your company's lockout/tagout safety procedures
- Through-the-door DeviceNet port gives you access to the network without opening the unit door
- Through-the-door viewing window gives you visible inspection of the disconnect without opening unit door

ArcShield™

The CENTERLINE 2100 Motor Control Center (MCC) with ArcShield helps reduce arc flash hazards while providing you with increased protection against internal electrical arcing faults. The CENTERLINE 2100 MCC, the first to offer arc resistant features in a low voltage design (up to 600 volts), helps improve personnel safety with a variety of built-in protective features designed to reduce and minimize arc flash hazards. Arc-containment latches provide an extra level of protection against internal arcing faults.

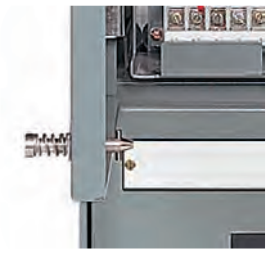
The CENTERLINE 2100 MCC with ArcShield meets Type 2 accessibility requirements (as defined by IEEE C37.20.7-2007 – "IEEE guide for testing metal-enclosed switchgear rated up to 38kV for internal arcing faults"), helping to shield your personnel from the effects of an internal arcing fault on the front, rear and sides of the enclosure. Pairing ArcShield with IntelliCENTER technology, you can perform remote monitoring, configuration and troubleshooting of your MCCs, without entering the arc flash boundary zone – helping to further reduce your exposure to arc flash hazards.

CENTERLINE 2100 MCC with ArcShield

"The safety issue is one of the things that we are happiest with. The old system created hazardous troubleshooting conditions, with technicians having to test and probe and work around live wires within a confined panel space."

Ronnie Sexton
Acme Brick – USA

Pressure relief vents allow hazardous gases to escape from the top of the MCC



Arc-containment door latches help deliver an extra level of protection against internal electrical arcing faults

ArcShield is built on the rugged structural design and inherent safety features of the CENTERLINE 2100 MCC, including a recessed horizontal bus and labyrinth vertical bus support which helps to prevent arcs from spreading between phases; true unit and wireway isolation and special arc-containment door latches that help deliver an extra level of protection against internal electrical arcing faults that may occur when the doors are closed and latched.

Patent-pending arc resistant baffles for the CENTERLINE 2100 MCC with ArcShield lets you choose from the full range of MCC units, even those needing venting, such as variable frequency drives (VFDs). The arc-resistant baffles maintain Type 2 accessibility.

CenterONE® Software

CenterONE software is an intuitive, Windows-based application that helps you quickly configure CENTERLINE 2100 Motor Control Centers (MCCs).

CenterONE makes inputting data simple, you can enter your MCC attributes with familiar drop-down menus and import your equipment lists from an ASCII text file. You can even specify universal attributes to be applied across multiple units. CenterONE allows you to easily make changes, with simple drag and drop layout that allows you to arrange units and sections as needed. CenterONE can generate structural specifications, individual unit specifications, front elevation layouts, one-line diagrams and even your request for quotation.

CenterONE software makes selection easy. It shows all available options and its auto arrange feature expertly sets MCC units in logical positions.

Selection Process

Select a CENTERLINE 2100 Motor Control Center

Select Technology

Choose the type of networking technology, diagnostic and HMI software tools and additional arc flash safety features

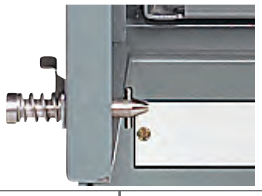
Select Structure

Choose the NEMA enclosure, section height, depth, wireway size and type of shutters

Select Power Systems

Choose electrical system, incoming power, power and ground bus, horizontal and vertical power bus capacity, bus withstand and short circuit withstand rating

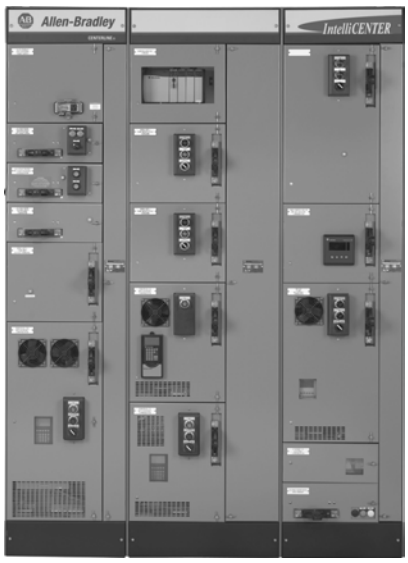
Select Unit Designs



Choose type of door latches and color and type of nameplates

Select Unit Types

Choose the type of units and unit specific options from lugs and breakers, non-motor loads, starters, space saving NEMA starters, metering units, soft starters, variable frequency drive, PLCs and pilot devices



CENTERLINE® 2100 Motor Control Centers

The CENTERLINE 2100 Motor Control Center (MCC) combines rugged-durability and premium quality, meeting UL and NEMA standards. CENTERLINE 2100 MCCs integrate control and power in one centralized package with a wide variety of motor control options. The industry leading motor control center that has delivered the safety, performance and reliability you need for over 35 years.

Product Features

- Designed to meet NEMA and UL standards
- Listed by UL as complying with MCC Standard UL 845
- Built-in DeviceNet with IntelliCENTER® technology
- ArcShield™ helps you reduce arc flash hazards
- Consistent design allowing for backward compatibility
- Proven CENTERLINE bus design with labyrinth bus support system
- Solid grounding system to help reduce shock hazards
- Fully isolated enclosures for maximum fault containment
- Space saving designs decrease the number of sections needed, reducing your MCC footprint
- Variety of intelligent motor control options
  - Across-the-line starters
  - Soft starters
  - Variable frequency drives

IntelliCENTER Technology

Built-in Networking

- Media protected behind barriers
- Access ports in wireways
- Trunk and drop topology allows for addition and removal of devices without shutting down the network

Intelligent Motor Controls

- PowerFlex® drives
- SMC™-3 and SMC™ Flex soft starters
- E1 Plus, E3 Plus electronic overload relays
- DeviceNet Starter Auxiliaries

IntelliCENTER Software

- Elevation View
- Monitor View
- Documentation View
- Spreadsheet View

Factory Configuration

- Network media validation
- Node configuration
- Device communication check

IntelliCENTER technology improves the intelligence of your MCC using built-in DeviceNet to capture information used for predictive maintenance, process monitoring, and advanced diagnostics.

Network

Based on the latest in network technology, DeviceNet is a simple, open networking solution, allowing for real-time control, data exchange, configuration and data connection at regular intervals or on demand. This robust communication link connects industrial devices (such as limit switches, photoelectric sensors, motor starters, push buttons, variable frequency drives and operator interface devices) to a network and eliminates time-consuming and costly hard wiring.

The cost and performance of a DeviceNet network makes it ideal for MCC applications. The open specifications and protocol, managed by the Open DeviceNet Vendor Association (ODVA), means vendors are not required to purchase hardware, software or licensing rights to connect to a system. Over 300 vendors offer DeviceNet products with over a half million nodes installed worldwide.

Linking Devices

EtherNet/IP and ControlNet linking devices allow you to quickly connect your factory network to a CENTERLINE 2100 MCC with IntelliCENTER technology. With an Integrated Architecture solution you can seamlessly access parameters through an HMI, for motor control across hundreds of motors. The bridging capabilities of IntelliCENTER technology also allow you to connect to a variety of other industrial networks.

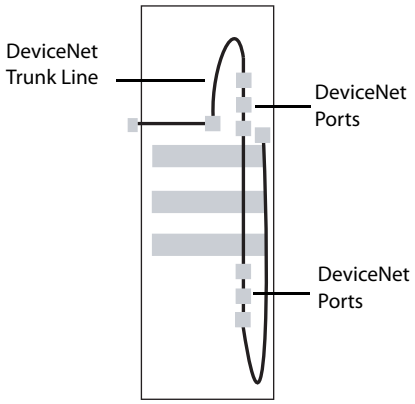
DeviceNet Cabling

All trunk and drop DeviceNet cabling is ODVA certified Class 1, with 600V insulation and 8 A rating. The DeviceNet cabling system for IntelliCENTER Technology has been extensively tested for noise immunity with network cables in close proximity to high current motor leads. IntelliCENTER technology provides a robust network solution.

DeviceNet Cable Layout

The DeviceNet trunk line is routed through the vertical wireway of the MCC. Trunk lines are routed behind barriers to isolate the cable from the unit space and wireways to help prevent accidental damage.

Up to six DeviceNet ports can be provided in the control and network wireway. Each DeviceNet component in an MCC unit is connected to the network through a port located in the wireway. Adding or removing units from the network does not interrupt the other units operating in the system.



Inside look at DeviceNet cable routing in one CENTERLINE 2100 MCC section

DeviceNet System Performance

The DeviceNet system in the MCC is designed to operate at 500 kbaud to maximize performance. To achieve best performance, all MCCs are engineered for a 250 kbaud minimum communication rate.

The DeviceNet system in the MCC is qualified to communicate and perform under normal and adverse electrical environments (for example, contactor electrical operation, contactor jogging duty and unit short circuit fault).

The DeviceNet system has the following capabilities:

- Automatic Device Replacement (ADR) which automatically downloads the parameter settings of a failed device to its replacement.
- On-line Scanlist Changes at Run, allows network modifications to be performed on a DeviceNet system that is running.
- By choosing the appropriate scan mode (Polled, Change of Stat (COS), Strobe and Cyclic) for different data, DeviceNet systems can achieve better throughput performance than networks with much higher communication rates.
- Allow the control system to access every parameter in the device, not just a few registers, by transmitting and receiving data via I/O explicit messaging.

IntelliCENTER Software

The CENTERLINE 2100 MCC is available with pre-configured IntelliCENTER software. IntelliCENTER software is an intuitive software package that is customized to your MCC. This software package includes several preconfigured views for easy access to important information and is capable of viewing multiple MCC line-ups. IntelliCENTER software can be installed and operated on EtherNet/IP, ControlNet or DeviceNet. The IntelliCENTER software is capable of functioning as a stand alone software package or as an ActiveX control in a Human Machine Interface (HMI). The IntelliCENTER software displays the following:

Elevation View

The elevation view is an easy-to-identify, graphical representation of your entire MCC lineup. The condition of each motor controller is quickly established with status light indicators. Customizable text gives you instant identification of your motors, machines or processes.

- Navigate immediately to units of concern by simply double-clicking on them
- Re-arrange the elevation view using simple drag-and-drop
- Select units for which you would like to see manuals, wiring diagrams or spare parts

Monitor View

The monitor view displays an overview of the intelligent motor control device being monitored, with configurable gauges, trend graphs, I/O status on the device and configurable data fields.

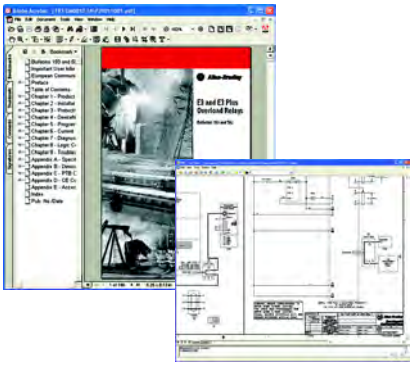
- Monitor parameters from the intelligent devices
- Change configuration parameters
- Record and export up to 5000 data points with the trend graph
- Change which parameters are displayed in the monitor view

Documentation Views

Documentation view has access to the various manuals and diagrams for your MCC along with other important MCC information.

Manuals and Wiring Diagrams

The IntelliCENTER software data CD comes with the complete documentation for your MCC, including wiring diagrams and device manuals. So your manuals are quickly available when you need them most.

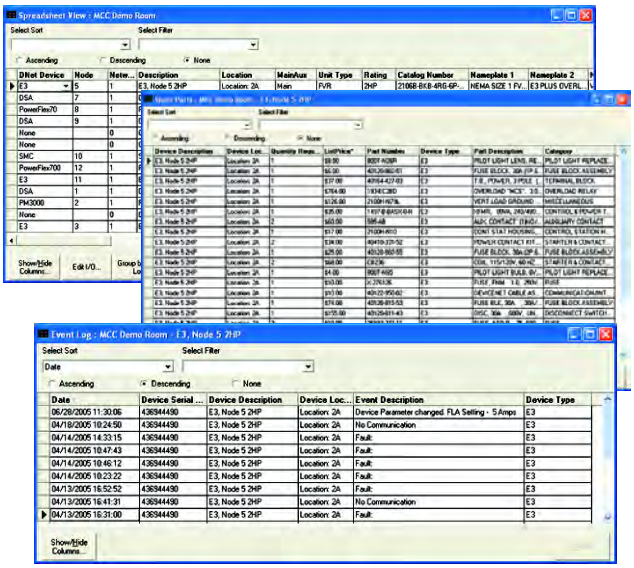


- Troubleshoot problems using the exact manuals for your MCC
- Trace out wiring and understand control circuits using wiring diagrams
- Add new documentation (procedures, engineering notes) associated with your MCC
- Substitute ‘as-built’ drawings with your ‘as-installed’ drawings

Spreadsheet View

The spreadsheet view allows you to access MCC data such as:

- Node number (network address)
- Unit description
- Nameplate data
- Device type



Event Log View

The event log records and stores events with date and time information occurring within your MCC and stores them with their date and time. Events can include device warnings and faults as well as parameter or device changes.

Spare Parts List

The spare parts list provides you with the exact replacement part needed to repair your MCC unit. This helps save time when calling your authorized Allen-Bradley distributor. User defined fields allow entry of your specific spare part information.

Integrated Architecture

All the IntelliCENTER software views are available as ActiveX objects which can be readily accessed by FactoryTalk View software or other HMI software packages. The IntelliCENTER software data CD includes network configuration files to generate descriptive tags in your RSLogix 5000 project.

- Reducing PLC development time with Automatic Tag Generation
- Enabling PLC programmer to complete network configuration before MCC is powered up
- Significantly reducing HMI programming time needed to reproduce these views
- Getting the functionality of all these views by simply configuring the ActiveX object

DeviceNet Components

Each unit can be provided with a DeviceNet component.

- Starter units can be provided with an E1 Plus with DeviceNet module, E3 or E3 Plus overload relays or eutectic overload relays with a DeviceNet Starter Auxiliary.
- Contactor units can be provided with a DeviceNet Starter Auxiliary.
- Variable frequency AC drives can be provided with a DeviceNet communication module.
- Solid-state controllers can be provided with DeviceNet communication modules and, in some instances, a DeviceNet Starter Auxiliary.
- Fusible disconnect and circuit breaker feeder circuits can be provided with a DeviceNet Starter Auxiliary.

Testing

IntelliCENTER technology can save you time because each MCC is pre-wired and the network is pre-programmed and validated at the factory. Network devices are pre-configured with node addresses and communication rates, ready to communicate so you can configure device parameters (for example, acceleration time and full load amps) via the network.

For more information on MCCs with DeviceNet, refer to CENTERLINE Motor Control Centers with DeviceNet, publication 2100-TD019.

IntelliCENTER Database

The IntelliCENTER database contains all of your order-specific information. One IntelliCENTER database is needed for each MCC lineup or for individual units (when the unit is purchased separately). The database is installed on the computer or computers running the IntelliCENTER software. The database CD includes the IntelliCENTER data files, all of the electronic documentation, all the up-to-date EDS files for the DeviceNet devices and the DeviceNet configuration file as recorded during the final system test of the MCC. The EDS and configuration files are very useful for programming the control system, allowing the programmer to complete the project before the equipment is even energized. Additionally, when used with RSLogix 5000 and RSNetworx for DeviceNet software, the programmer can use the DeviceNet Tag Generator utility in RSLogix 5000 to instantly generate descriptive tags for every device in the MCC.

Notes:

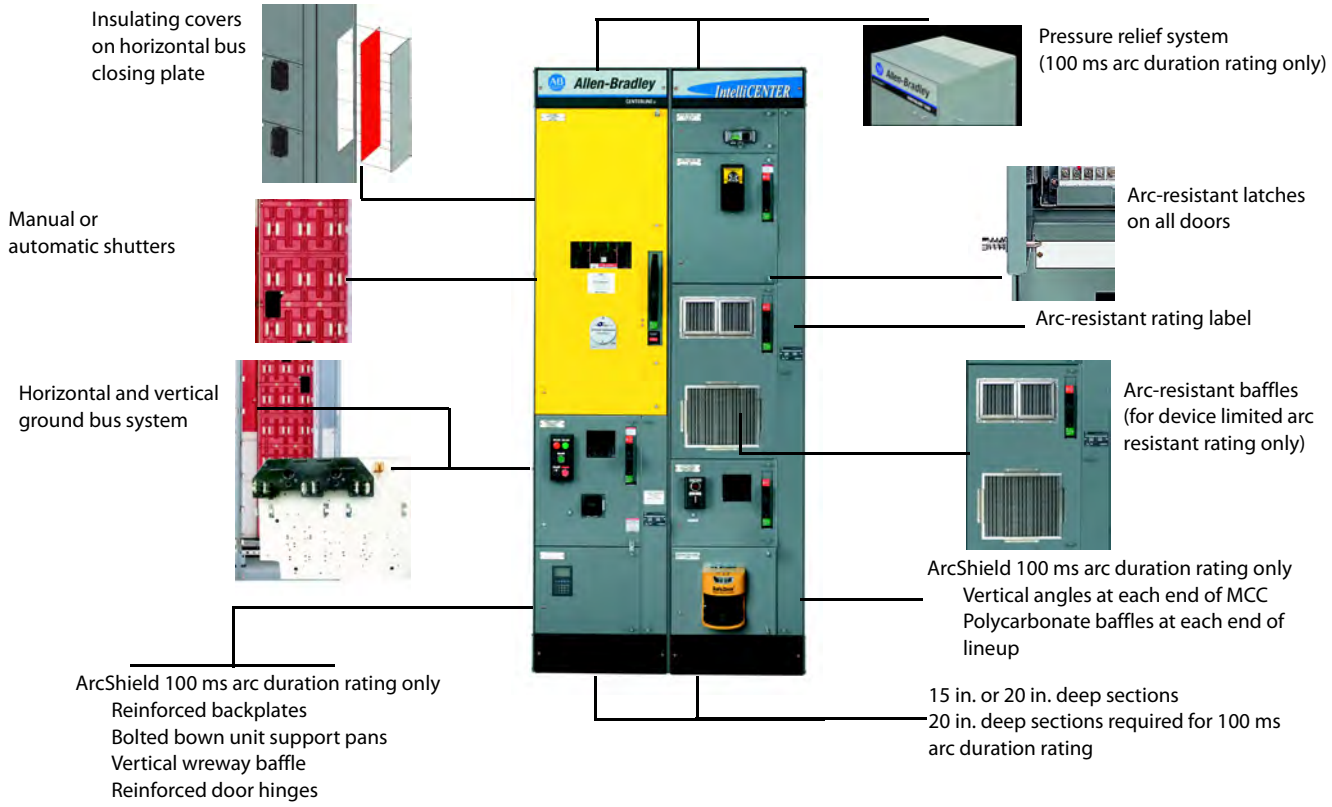
ArcShield

CENTERLINE 2100 Motor Control Center with ArcShield is an enhanced version of the industry-leading CENTERLINE 2100 MCC and is the first and only NEMA low voltage MCC to offer an arc resistant design. CENTERLINE 2100 MCC with ArcShield provides enhanced personnel protection and reduced exposure to arc flash hazards per IEEE C37.20.7-2007, IEEE Guide for Testing Metal-Enclosed Switchgear Rated up to 38 kV for Internal Arcing Faults. Two arc resistant ratings are available: Device-limited and 100 ms arc duration.

CENTERLINE 2100 MCC with ArcShield

	Device-limited Rating	**100 ms Arc Duration Rating**
Rated Voltage	Up to 600V	Up to 480V
Available Fault Current	Up to 65 kA	Up to 65 kA
Horizontal Bus Current Rating	600…1200 A	600…3000 A
Section Depth	15 in. or 20 in.	20 in.
Horizontal Bus Closing Plate Insulation	Yes	Yes
Arc Latches on Vertical Wireway Door	Yes	Yes
Vertical Bus Isolation	Automatic or Manual Shutters Required	Automatic or Manual Shutters Required
Vertical Plug-in Ground Bus	Copper or Copper/Tin Required	Copper or Copper/Tin Required
Vertical Load Ground Bus	Optional	Copper or Copper/Tin Required
Horizontal Ground Bus	Top, Bottom or Both	Top and Bottom Required
Top-plate Pressure Relief System	Not required	Required
Reinforced Backplate and Sidesheet	Not required	Required
Vertical Angle at Each End of MCC Line-up	Not required	Required
Vertical Wireway Baffle	Not required	Required
Arc Containment Latches	2 latches per door	All latches
Unit Support Pans	Standard	Bolted
Door Hinges	Standard	Reinforced
Door mounted devices allowed (control stations, HIMs, viewing windows)	Yes	Yes
Vented Units Allowed	Yes, with arc resistant baffles	No
Half Space Factor Units Allowed	Yes	No

ArcShield Features


Insulating covers on horizontal bus closing plate
Manual or automatic shutters
Horizontal and vertical ground bus system
ArcShield 100 ms arc duration rating only
Reinforced backplates
Bolted bown unit support pans
Vertical wreway baffle
Reinforced door hinges
Allen-Bradley
IntelliCENTER
Pressure relief system (100 ms arc duration rating only)
Arc-resistant latches on all doors
Arc-resistant rating label
Arc-resistant baffles (for device limited arc resistant rating only)
ArcShield 100 ms arc duration rating only
Vertical angles at each end of MCC
Polycarbonate baffles at each end of lineup
15 in. or 20 in. deep sections
20 in. deep sections required for 100 ms arc duration rating

In combination with the standard safety features built into every CENTERLINE 2100 MCC, choosing ArcShield provides you additional benefits, including:

- Type 2 Accessibility for enhanced personnel protection at the front, sides and rear of the MCC.
- Performance tested arc-resistant latches on all doors capable of withstanding the high internal pressure generated by an arc blast keep doors latched and secured to the MCC during an arcing fault.
- Manual or automatic shutters help to protect against potential electrical shock hazards from unused plug-in stab openings.
- Copper vertical ground bus and heavy duty ground stab on plug-in units provides an effective path for ground fault currents which helps to minimize fault clearing times of overcurrent protective devices.
- Insulating covers on horizontal bus closing plates help prevent 'burn through' which may result from arcing faults in the horizontal bus compartment.
- Vented units with arc-resistant baffles to allow for a wider range of MCC equipment for NEMA Type 1 Enclosures while maintaining Type 2 Accessibility (ArcShield with device-limited arc-resistant rating only).
- Pressure relief system designed to exhaust gases through the top of the enclosure, away from personnel
  (ArcShield with 100 ms arc duration rating only).

CENTERLINE 2100 MCCs with ArcShield can also be supplemented with IntelliCENTER technology. The remote maintenance and troubleshooting capabilities of IntelliCENTER technology keeps you out of the flash boundary and safe from electrical and arc flash hazards. You can perform the following procedures with the unit doors closed:

- Overload detection (monitor warnings and trips)
- Change overload relay setting (full load amperes and trip class)
- Measure and monitor phase currents
- Measure baseline motor currents
- Ground fault detection (monitor warnings and trips)
- Monitor motor thermistor
- Time to trip and time to reset
- Reset overload relays
- Event history
- Verify control power
- Verify starter operation

Structure

The CENTERLINE 2100 Motor Control Centers structure consists of sections, wireways, doors and plug-in or frame mount units. CENTERLINE 2100 MCCs are listed by UL as complying with MCC Standard UL 845.

Sections

The rigid, free-standing sections are assembled individually. Shipping blocks are factory assembled from individual sections. Multiple section shipping blocks have continuous lifting angles, horizontal power bars, horizontal ground bus and internal mounting angle.

Fault containment is enhanced with two side sheets on every section. This helps prevent a single fault from cascading throughout the structure, limiting equipment damage.

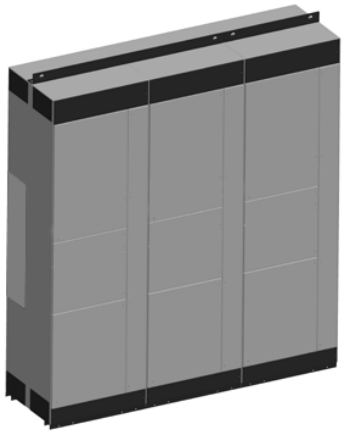
The regid design or CENTERLINE 2100 MCCs helps ensure a longer life in all applications. Plug-in units can still be installed and removed and doors closed securely after years of dependable service.

Mounting Configurations

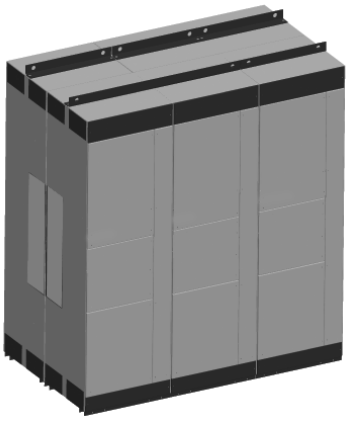
The MCC is available in two mounting configurations – front mounted and back-to-back mounted.

- Front mounted sections are joined and installed side-by-side.
- Back-to-back mounted sections are two separate sections joined at the rear. The two sections have separate power bus systems providing the same phasing for all units. The horizontal power bus is linked, front to rear, with a factory installed U-shaped bus splice assembly.

  Back-to-back vertical sections are made up of two separate vertical sections. The front and back sections have separate horizontal and vertical power bus providing the same phasing on units, both front and back. Full usage of unit space is available for front and back section. There is no back plate between the sections.



Front Mounted



Back-to-back Mounted

Bus Design

CENTERLINE bus design means more current carrying capacity per section.

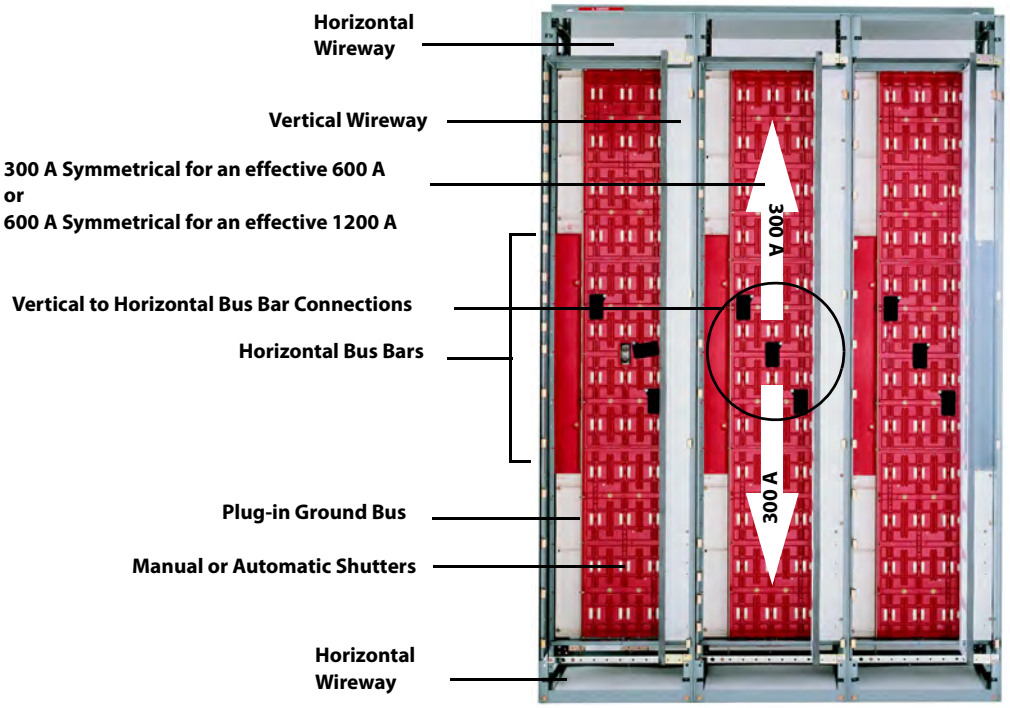
- Standard **vertical bus** is rated twice the industry norm: 300 A above and 300 A below the **horizontal bus** for an effective 600 A capacity per section
- Allows more flexibility for field changes without exceeding vertical bus rating
- Sections available in back-to-back design with separate front and rear vertical bus for maximum loading capacity
- Continuous bus bracing provides more uniform support than commonly used standoffs

Vertical wireway contains no control or power terminations making cable installation safer. For added safety, a permanent barrier separates the vertical wireway from units. **Automatic shutters** available to immediately isolate vertical bus when unit is removed.

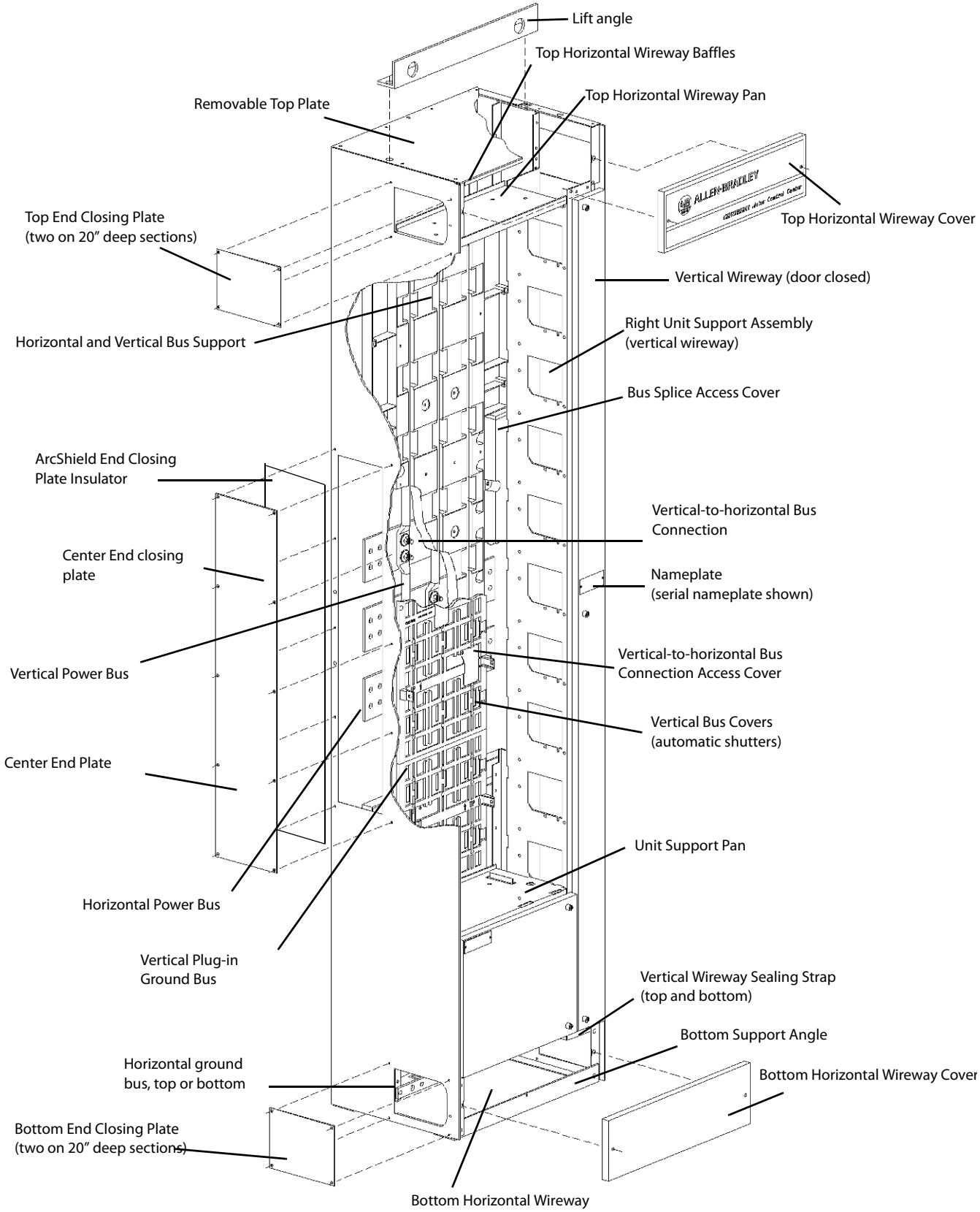
Computerized fastening system used in the assembly of horizontal to vertical bus connection:

- reduces periodic maintenance
- minimizes exposure to hazardous voltage

Dedicated **plug-in ground bus** is part of a solid grounding system.



Section Construction

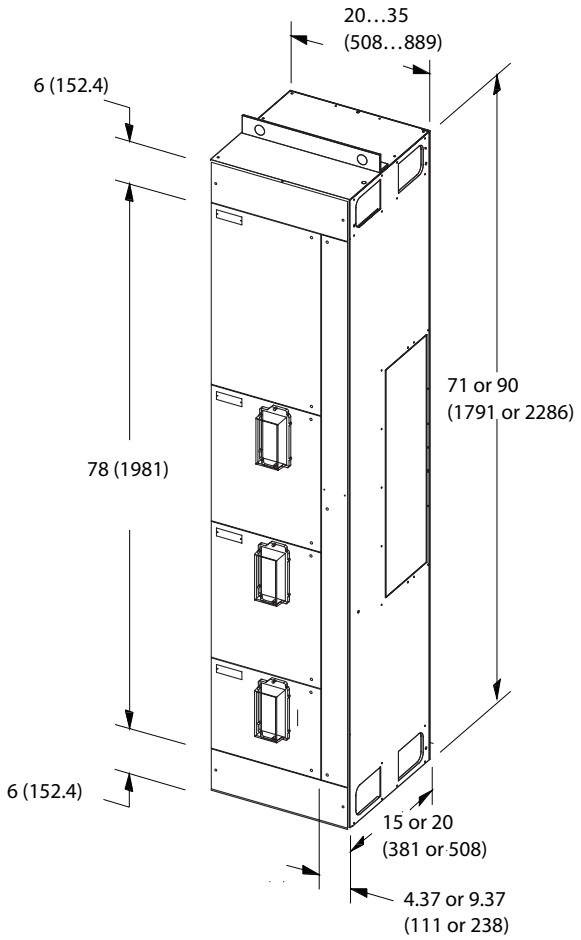


Section Dimensions

The standard dimensions of a vertical section are 90 in. high x 20 in. wide x 15 in. deep (2286 mm x 508 mm x 381 mm).
Vertical sections are also available as 20 in. deep (508 mm). Some vertical sections may be wider than 20 in. (508 mm) due to larger equipment or optional vertical wireway.

Optional 71 in. (1791 mm) reduced height vertical sections are available. These sections can be either 15 in. (381 mm) or 20 in. (508 mm) deep and each 71 in. high vertical section accommodates standard plug-in units up to and including 4.5 space factors.

Dimensions are shown as in. (mm).



Section Dimensions

Height	90 in. (2286 mm) standard; 71 in. (1790 mm) available
Width	20 in. (508 mm) standard; wider sections available for larger equipment in 5 in. (127 mm) increments
Depth	Front mounted 15 in. (381 mm) or 20 in. (508 mm) Back-to-back 30 in. (762 mm) or 40 in. (1016 mm)
Vertical Wireway	4.37 in. (111 mm) wide standard; 9.37 in. (238 mm) wide available

Approximate Weight

This table lists approximate weights for MCC sections. Many factors (number of units, horizontal power bus, wireway width, section depth and width) affect the weight of the sections. Weight is also added when the product is packaged for shipping.

Approximate Weight

MCC Section Dimensions	NEMA Type 1 , 1G or 12 lb (kg) per section[1]
15″/20″ D, 20″ W, 90″ H	500 (227)
15″/20″ D, 25″ W, 90″ H	575 (261)
15″/20″ D, 30″ W, 90″ H	600 (272)
15″/20″ D, 35″ W, 90″ H	650 (295)

(1) Weights are for a typical motor control center with four units per section. Weights do not include packaging. Refer to packing slip shipped with you MCC for exact shipping weights.

Technical Data

Standards	Certifications & Listings	NEMA ICS-18, UL845, CSA C22.2 No. 14 and EN 60439-1
	NEMA Type	1 (IP20, IP30, IP40) 1 with gasketing around perimeter of unit doors (IP20, IP30, IP40) 12 (IP54) 3R non walk-in (IP44) 4 non walk-in (IP65)
Bus Material and Plating	Horizontal Bus Rating	600 A; 800 A; 1200 A; 1600 A; 2000 A; 2500A or 3000A
	Horizontal Bus Withstand Rating	42 kA; 65 kA or 100 kA
	Horizontal Bus Material	Aluminum with Tin-plating; Copper with Tin-plating or Copper with Silver-plating
	Vertical Bus Rating	300 A (600 A effective) or 600 A (1200 A effective)
	Vertical Bus Material	Copper with Tin-plating or Copper with Silver-plating (matches horizontal bus material)
Unit Design	Unit Size	6.5″ (165 mm) high x 14″ (356 mm) wide = half space factor 13″ (330 mm) high x 14″ (356 mm) wide = one space factor Unit designs are in 0.5 space factor increments
	Maximum Space Factors per Section	6
Structural Surface Treatments	Exterior (NEMA Type 1, 1G, 12)	ANSI 49 - Medium Light Gray
	Exterior (NEMA Type 3R)	UV Resistant High Gloss White - Recognized by UL for outdoor use
	Exterior (NEMA Type 4)	Unpainted Stainless Steel
	Interior	ANSI 49 - Medium Light Gray; High Visibility White Gloss (vertical wireways and unit back plates)
Environment	Storage Temperature	32…104 °F (0…40 °C) with up to 95% non-condensing humidity
	Operating (Ambient) Temperature	32…104 °F (0…40 °C) with up to 95% non-condensing humidity
	Altitude	6600 feet (2km)

NEMA Enclosure Type

Structures are available with the following NEMA Enclosure Type ratings.

- NEMA Type 1
- NEMA Type 1 with gasketing around perimeter of unit doors
- NEMA Type 12
- NEMA Type 3R (non walk-in)
- NEMA Type 4 (non walk-in)

Structure sheet metal has rounded edges and is tightly fitted with no visible air gaps. See Technical Standards and Certifications, page 97 for more information.

Operating Environment

The MCC is designed to operate in an ambient operating temperature range of 0…40 °C (32…104 °F) with up to 95% non-condensing humidity.

The MCC is designed to operate at altitudes up to 2000 m (6600 ft) without derating. For MCCs with variable frequency drives, the MCC may be operated at altitudes up to 1000 m (3300 ft) without derating.

Paint and Plating

Structural metal undergoes a multi-step cleaning, rinsing and painting process resulting in complete uniform-thickness, paint coverage. This process is maintained and controlled by ISO 9001 quality standards.

Unpainted surfaces for corrosion resistance.

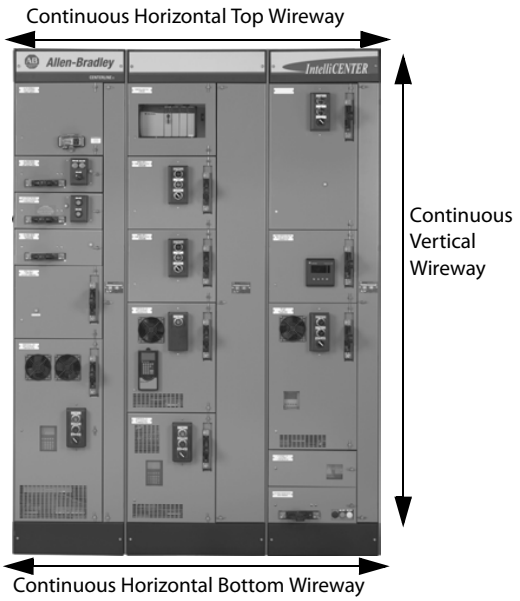
MCC Finish

NEMA Enclosure Type	Exterior Finish
1, 1G, 12	ANSI 49, Medium Light Grey
3R	High Gloss White (for outside use)
4	Stainless Steel

Interior vertical wireways and unit mounting plates are painted high-visibility gloss white.

Wireways

Each MCC has horizontal and vertical wireways for continuous dedicated wire and cable location.



Horizontal Wireways

Horizontal wireways are located at the top and bottom of each MCC section. Horizontal wireways extend the full width and depth of the MCC. The top and bottom are horizontal wireways 6 in. (152.4 mm) high. Complete wireway access from front to rear is available for back-to-back configured MCC sections.

Horizontal wireways have removable front covers that are held in place by captive screws. Openings in the side plate of the section allow access to the top and bottom horizontal wireways between joined sections. Plates are provided to cover these openings for sections located at the end of a MCC lineup.

Horizontal wireways are isolated from the power bus. Horizontal wireways for incoming line sections are reduced depth to maintain isolation from the incoming line area.

Vertical Wireway

The vertical wireway is located on the right side of each section and extends 78 in. (1981 mm), between the top and the bottom horizontal wireway. The vertical wireway is approximately 7 in. (178 mm) deep. The standard vertical wireway is 4.37 in. (111 mm) wide. Vertical wireways are also available in 9.37 in. (238 mm) widths.

The vertical wireway is isolated from power bus and is independent of unit space. Vertical wireways are not present in sections with frame-mount units.

Vertical wireways are covered with steel doors and held in place by at least three door latches.

Vertical wireway tie bars are available to help you keep your cable wireways organized.

Master Nameplate

The MCC master nameplate, when specified, measure 2.0 in. x 6.0 in. (50.8 mm x 152.4 mm) and is available with up to five lines of engraving and is located on the top horizontal wireway cover.

Incoming Power

CENTERLINE 2100 Motor Control Centers are designed for use on three-phase, three-wire or four-wire, Wye connected power systems, rated 600V or less, 50 or 60 Hz, with a solidly grounded neutral. CENTERLINE 2100 Motor Control Centers are also suitable for the following power system configurations, however, some units and options may not be available:

- 3-phase, 3-wire, Wye systems rated 600V/347V or less, with impedance grounded neutral
- 3-phase, 3-wire, ungrounded Delta systems, rated 600V or less

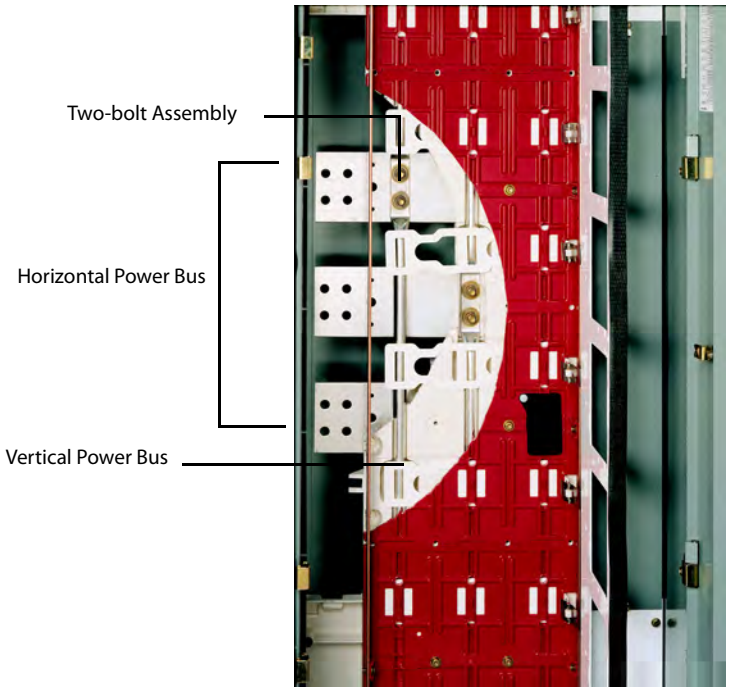
Power Bus and Ground Bus

The CENTERLINE 2100 MCC features the time-proven Allen-Bradley CENTERLINE power bus system. The horizontal power bus is mounted near the vertical center of the structure providing optimum heat dissipation, power distribution and ease of maintenance and installation.

The vertical power bus allows power distribution both above and below the center-mounted horizontal bus, effectively doubling the capacity in each section. This feature also helps allow a virtually unrestricted unit arrangement.

Horizontal and vertical power buses are fastened together with a two bolt assembly. This two-bolt connection helps minimize the likelihood of 'hot spots'. The factory-made horizontal to vertical power bus connection is tightened by a computerized torquing system.

The power bus system is supported, braced and isolated by a bus support molded of high strength, non-tracking glass polyester material.



Horizontal Power Bus

The horizontal power bus is available as follows:

- 600…800 A - aluminum with tin plating
- 600…3000 A - copper with tin plating or copper with silver plating

The horizontal power bus is continuous in each shipping block and mounted near the vertical center of the structure providing optimum heat distribution, power distribution and ease of maintenance and splicing. The horizontal power bus is mounted on-edge in a vertical plane providing maximum strength to withstand magnetic forces present during fault conditions. It is mounted in recessed channels of the bus support to protect against accumulation of dust and tracking between phases.

Vertical Power Bus

Vertical power bus bars are cylindrical providing optimum contact with the unit plug-in stabs. Vertical power bus bars are continuously braced by a high strength, non-tracking glass polyester material and sandwiched by a glass filled polycarbonate molded bus cover isolating the vertical power bus from the other vertical phases and the horizontal power bus. The standard vertical power bus is a copper tube rated 300 A above and below the horizontal power bus for an effective 600 A rating. An optional copper rod rated 600 A above and below the horizontal power bus for an effective 1200 A rating is available. The vertical power bus is tin-plated or silver-plated. The plating of the vertical power bus matches the plating of the horizontal power bus.

Horizontal Neutral Bus

The horizontal neutral bus, when required for four-wire systems, is available and may be located above or below the horizontal power bus. Connections to the neutral bus are made though neutral connection plates mounted in the horizontal wireways of various vertical sections or an optional vertical neutral bus located in a 9 in. (228 mm) wide vertical wireway.

Bracing

Fully rated bus bracing is available at 42, 65 or 100 kA rms symmetrical. Series coordinated bus bracing is also available at 100 kA rms symmetrical. Series coordinated bus bracing, when used with specific current-limiting mains, provides a cost affective alternative to 100 kA fully rated bus bracing.

Horizontal Ground Bus

The horizontal ground bus is available as unplated copper or tin-plated copper and may be located in the top and/or bottom horizontal wireway. The horizontal ground bus is available as 0.25 in. x 1 in. (6.35 mm x 25.4 mm) or 0.25 in. x 2 in. (6.35 mm x 50.8 mm). The 1/4 in. x 1 in. (6.35 mm x 25.4 mm) horizontal ground bus has an effective 500 A continuous rating and the 1/4 in. x 2 in. (6.35 mm x 50.8 mm) has an effective 900 A continuous rating. The horizontal ground bus has various sized holes evenly spaced along the length for making ground connections. A pressure type mechanical lug is mounted on the horizontal ground bus in the incoming line section. An outgoing equipment ground lug can also be mounted on horizontal ground bus.

Vertical Plug-in Ground Bus

The vertical plug-in ground bus is mechanically connected to the horizontal ground bus forming a complete internal ground system in each standard vertical section. The vertical plug-in ground bus in combination with the unit ground stab establishes a first make, last break operation of the ground connection with respect to the power connects.

The 0.1875 in. x 0.750 in. (4.74 mm x 19.05 mm) vertical plug-in ground bus can be:

- zinc plated steel.
- unplated copper.
- tin-plated copper.

Vertical Unit Load Ground Bus

The vertical unit load ground bus is mechanically connected to the horizontal ground bus. The vertical unit load ground bus in combination with the unit load connector provides a termination point for the load ground cable at the unit. This fixed connection does not need to be removed when withdrawing the unit from the MCC.

The 0.1875 in. x 0.750 in. (4.74 mm x 19.05 mm) vertical unit load ground bus can be unplated or tin-plated copper.

Vertical Bus Plug-in Stab Opening Protection

Several options are available for covering unused plug-in stab openings:

- Protective caps
- Manual shutters
- Automatic shutters

Automatic shutters open as plug-in units are inserted and close when the unit is removed. Automatic shutters help ensure the vertical bus is immediately isolated when a plug-in unit is removed.

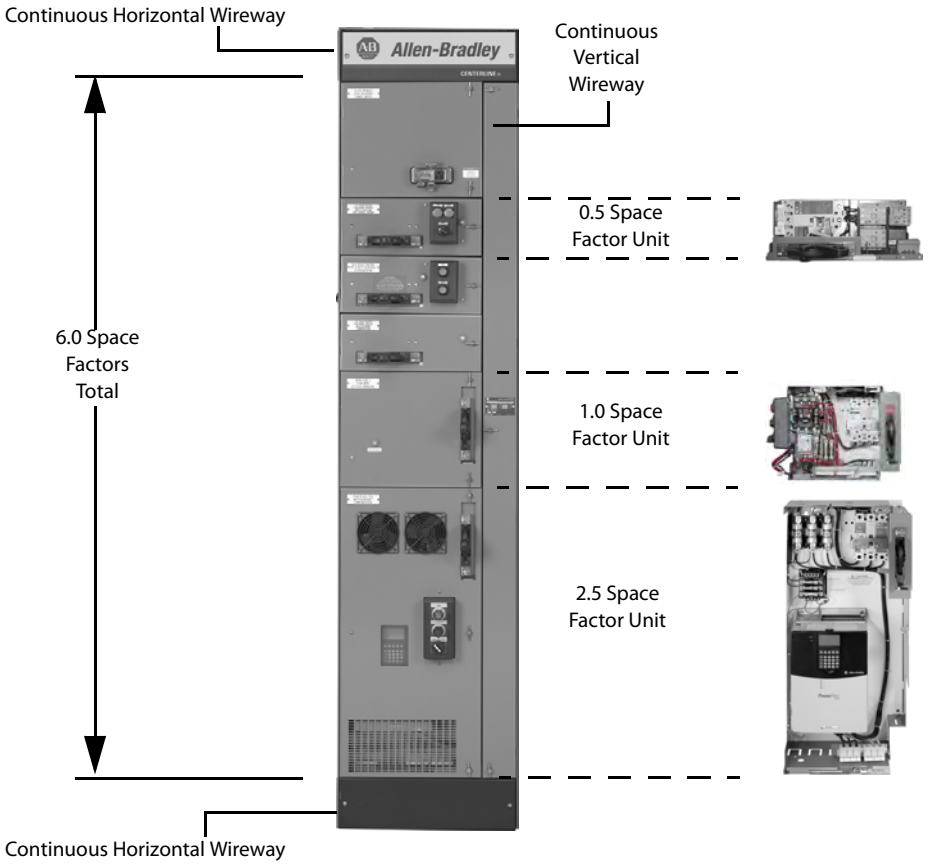
Other Structure Related Options

Other options such as pull boxes, master nameplates and space heaters are available.

For more information on structure options, refer to CENTERLINE 2100 Motor Control Centers Catalog, publication 2100-CA001.

Space Factor

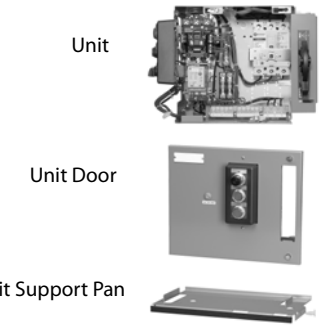
Unit size is described in space factors. Units are designed in 0.5 space factor increments. Each 0.5 space factor is 6.5 in. (165.1 mm) high. Each standard, 90 in. high MCC section can contain 6.0 space factors. Up to twelve 0.5 space factor units can be placed in a section.



Unit Design

Plug-in Unit Design Features

Plug-in units consist of the unit, unit support pan and unit door. Plug-in units are held securely in the section when inserted and are designed with an interlock to help ensure that units cannot be inserted or withdrawn when the disconnect means is in the ON/I position.



Frame Mounted Unit Design Features

Frame mounted units are permanently mounted in the section, all connections are made directly to the components. Fixed units range from 1 space factor to 6 space factors.

Disconnect Handle Mechanism

Flange style disconnect handles (vertical or horizontal mounted) are provided with units with disconnects.

The disconnect handle of all units is interlocked with the unit door so the disconnect means cannot be switched to the ON/I position unless the door is closed. This interlock also prevents you from opening the unit door unless the disconnect is in the OFF/O position. An externally operated defeater is provided if access to the unit is needed without interrupting service. The interlock also prevents the unit from being inserted or removed when the disconnect handle is in the ON/I position.

Unit Disconnect

Fusible disconnect switches are available in MCC units. The fusible disconnect switches have visible blade type movable contacts and supplied with Class J, R, H, L, HRCII-C or CC fuse clips. NEMA space saving starter units are limited to Bulletin 194R fusible disconnect switch with Class CC fuse clips. Fusible disconnect requirements above 400A use a bolted pressure contact switch with visible blade disconnect mechanism.

Circuit breaker disconnects are available in MCC units. Horsepower rated MCC units are provided with instantaneous circuit breakers (HMCP) or with inverse time (thermal magnetic or electronic) circuit breakers. Current rated units are provided with inverse time (thermal magnetic or electronic) circuit breakers.

Stab Assembly

The two-piece power stab housing is made of high strength, non-tracking glass polyester material and provides a separate, isolated pathway for each phase.

The power cable connection at the plug-in stab is made with a maintenance free crimp style connection. There is no exposed wiring at the back of the unit between the disconnecting means and the plug-in stabs.

Unit plug-in power stabs are rated 225 A. The stabs are made of tin-plated copper for a low resistance connection and are designed to tighten during heavy current surges.

The free-floating and self aligning unit plug-in power stabs are backed by stainless steel spring clips to provide and maintain a high pressure, four-point connection to the vertical power bus.

Pilot Devices

Pilot Device

Pilot devices are housed in a door mounted control station. Each control station can accommodate up to three 30.5 mm or four 22.5 mm devices.

The control station is easily removed from the unit door using captive screws. If a control station is removed, closing plates are available to cover the opening in the unit door and provide isolation, allowing the control station to stay with the unit when the unit is removed.

Unit Doors

Each unit is provided with a removable door mounted on removable pin type hinges which allow the door to open at least 110 degrees. The unit doors are removable from any location in the MCC without disturbing any other unit doors. The unit door is fastened to the structure so it can be closed to cover the unit space when the unit is removed. The unit doors are held closed with ¼-turn latches. Units with overload relays have a low profile external reset button.

Unit Nameplates

Unit nameplates measuring 1.125 in. x 3.375 in. (28.58 mm x 85.73 mm) are available and can accommodate three or four lines of engraving. The following types of unit nameplates are available:

- Clear cardholders - supplied with blank cards
- Engraved acrylic nameplates - white with black lettering or black with white lettering
- Engraved phenolic nameplates - white with black lettering, black with white lettering or red with white lettering

Nameplates are secured using two steel self-tapping screws. Stainless steel screws are also available.

Unit Types

You can choose from a variety of units including contactor and starter units, metering units, main and feeder units, lighting and power panel units, transformer units, combination soft starter units, variable frequency AC motor drive units and programmable controller units. Catalog numbers and complete selection rules can be found in the CenterONE® configuration software or the CENTERLINE 2100 Motor Control Centers Catalog, publication 2100-CA001.

Contactor and Starter Units

Combination Full-voltage Lighting Contactor Units (FVLC) - Bulletin 2102L and 2103L

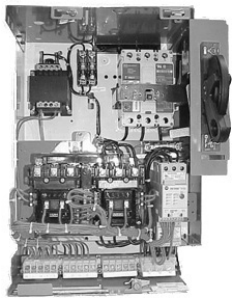
These combination lighting contactor units are supplied with an Allen-Bradley Bulletin 500L AC contactor and either a fusible disconnect or circuit breaker. They are rated 30…300 A. Each unit is provided as a NEMA Class I, Type B-T unit with terminals mounted in the unit for connection to remote devices. These full voltage reversing units are available with E1 Plus and E3 Plus electronic overload relays.

Bulletin 2102L and 2103L - Full Voltage Lighting Contactor Unit with Fusible Disconnect Switch or Circuit Breaker (FVLC)

Rating (A)	Transformer Primary Switching kVA										Bulletin 2102L			Bulletin 2103L	
	208V		240V		380V… 415V		480V		600V		Fuse Clip		Space Factor(1)	Circuit Breaker Frame	Space Factor(1)
	1∅	3∅	1∅	3∅	1∅	3∅	1∅	3∅	1∅	3∅	Rating (Amperes)	Class			
30	1.2	3.6	2.4	4.3	2.8	7.1	4.9	8.5	6.2	11	30	CC, J	0.5	I3C, I6C	0.5
30	1.2	3.6	2.4	4.3	2.8	7.1	4.9	8.5	6.2	11	30	CC, J, R, H	1.0	I3C-CL , I3C, I6C	1.0
DUAL 30	1.2	3.6	2.4	4.3	2.8	7.1	4.9	8.5	6.2	11	—	—	—	I3C, I6C	1.5
60	2.1	6.3	4.1	7.2	6.8	11.8	8.3	14	10	18	30, 60	J, R, H	1.0	I3C-CL , I3C, I6C	1.0
DUAL 60	2.1	6.3	4.1	7.2	6.8	11.8	8.3	14	10	18	—	—	—	I3C, I6C	1.5
100	4.1	12	8.1	14	13.3	23.3	16	28	20	35	60, 100	J, R, H	2.5	I3C-CL, I3C, I6C	1.5
200	6.8	20	14	23	22.5	39	27	47	34	59	100, 200		3.0	JD3D, JD6D	2.5
300	14	41	27	47	45	78.3	54	94	68	117	200, 400		4.0	K3D, K6D	3.5

(1) Adding options may increase the space factor of the unit.

Combination Full Voltage Reversing Starter Units (FVR) - Bulletin 2106 and 2107



These combination full voltage reversing starter units are supplied with an Allen-Bradley Bulletin 505 reversing starter and either a fusible disconnect or a circuit breaker. The Bulletin 2106 and 2107 starters are rated for NEMA sizes 1 through 5 and are mechanically and electrically interlocked to avoid both contactors being closed simultaneously. Each unit is provided as a NEMA Class I, Type B-T unit with terminals mounted in the unit for connection to remote devices. Full voltage reversing starter units are available with a eutectic alloy, E1 Plus or E3 Plus electronic overload relay.

Bulletin 2106 and 2107 - Full Voltage Reversing Starter Unit with Fusible Disconnect Switch or Circuit Breaker (FVR)

NEMA Size	Horsepower				Bulletin 2106			Bulletin 2107	
	208V	240V	380…415V	480/600V	Fuse Clip		Space Factor(1)	Circuit Breaker Frame	Space Factor(1)
					Rating (Amperes)	Class			
1	0.125…7.5	0.125…7.5	0.125…10	0.125…10	30	CC, J, R, H, HRCII-C	1.5	MCP, MCP-ELC, I3C, I3C-CL, I6C	1.5
					60	J, R, H, HRCII-C			
2	10	10…15	15…25	15…25	30, 60, 100	J, R, H, HRCII-C J, R, H, HRCII-C J	1.5		1.5
					100	R, H, HRCII-C	2.0		
3	15…25	20…30	30…50	30…50	60, 100, 200	J, R, H, HRCII-C J, R, H, HRCII-C J, R, H, HRCII-C	3.0		2.5
4	30…40	40…50	60…75	60…100	100, 200, 400	J, R, H, HRCII-C J, R, H, HRCII-C J	4.0	MCP, MCP-ELC, JD3D, JD6D	4.0
5	50…75	60…100	100…150	125…200	200, 400, 600	J, R, H, HRCII-C J, R, H, HRCII-C J	6.0, 20"W	MCP, JC3D, K3D, JD6D, K6D	6.0, 20"W

(1) Adding options may increase the space factor of the unit.

Space Saving NEMA Combination Full Voltage Reversing Starter Units (FVR) - Bulletin 2106 and 2107

These combination full voltage reversing starter units offer a space saving alternative while utilizing an Allen-Bradley Bulletin 300 reversing starter and either a fused disconnect or a circuit breaker. The Bulletin 2106 Space Saving NEMA reversing starters are rated for NEMA Size 1 applications and the Bulletin 2107 Space Saving NEMA reversing starters are rated for NEMA Size 1 through 3 applications. The contactors are mechanically and electrically interlocked to avoid both contactors being closed simultaneously.

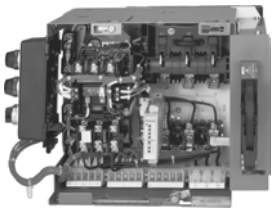
Each unit is provided as a NEMA Class I, Type B-D unit with terminals mounted in the unit for connections to remote devices. These full voltage reversing units are available with E1 Plus or E3 Plus electronic overload relays.

Bulletin 2106 and 2107 - Space Saving NEMA Full Voltage Reversing Starter Unit with Fused Disconnect Switch (FVR) or Circuit Breaker (FVR)

NEMA Size	Horsepower		Bulletin 2106			Bulletin 2107	
	480V	600V	Fuse Clip		Space Factor(1)	Circuit Breaker Frame	Space Factor(1)
			Rating (Amperes)	Class			
1	0.5…10	0.75…10	30	CC, J, HRCII-C	0.5	MCP, I3C, I6C	0.5
2	15…25	15…25	—	—	—		1.0
3	30…50	30…50	—	—	—		1.5

(1) Adding options may increase the space factor of the unit.

Combination Full Voltage Non-reversing Starter Units (FVNR) - Bulletin 2112 and 2113



These combination full voltage non-reversing starter units are supplied with an Allen-Bradley Bulletin 509 starter and either a fusible disconnect or a circuit breaker. The full voltage non-reversing starters are rated for NEMA sizes 1 through 6. Each unit is provided as a NEMA Class I, Type B-T unit, with terminals mounted in the unit for connection to remote devices. Full voltage non-reversing starter units are available with a eutectic alloy, E1 Plus or E3 electronic overload relay.

Bulletin 2112 and 2113 - Full Voltage Non-reversing Starter Units with Fusible Disconnect Switch or Circuit Breaker (FVNR)

NEMA Size	Horsepower				Bulletin 2112			Bulletin 2113	
	208V	240V	380…415V	480/600V	Fuse Clip		Space Factor[1]	Circuit Breaker Frame	Space Factor[1]
					Rating (Amperes)	Class			
1	0.125…5	0.125…5	0.125…10	0.125…10	30	CC, J, HRCII-C	0.5	MCP, I3C, I6C	0.5
1	0.125…7.5	0.125…7.5	0.125…10	0.125…10	30	CC, J, R, H, HRCII-C,	1.0	MCP, MCP-ELC, I3C, I3C-CL, I6C	1.0
					60	J, R, H, HRCII-C			
DUAL 1	0.125…7.5	0.125…7.5	0.125…10	0.125…10	—	—	—	MCP, I3C, I6C	1.5
2	10	10…15	15…25	15…25	30 60 100	J, R, H, HRCII-C J, R, H, HRCII-C J, HRCII-C	1.0	MCP, MCP-ELC, I3C, I3C-CL, I6C	1.0
					100	R, H	1.5		
DUAL 2	10	10…15	15…25	15…25	—	—	—	MCP, I3C, I6C	1.5
3	15…25	20…30	30…50	30…50	60 100 200	J J J	2.0	MCP, MCP-ELC, I3C, I3C-CL, I6C	1.5
					60 100 200	R, H, HRCII-C R, H, HRCII-C R, H, HRCII-C	2.5		
4	30…40	40…50	60…75	60…100	100 200 400	J, HRCII-C J, HRCII-C J	2.5	MCP, MCP-ELC, JD3D, JD6C	2.0
					100, 200	R, H R, H	3.0		
5	50…75	60…100	100…150	125…200	200 400 600	J J J	3.5	MCP, JD3D, K3D, JD6D, K6D	3.5
					200 400	R, H, HRCII-C R, H, HRCII-C	4.0		
6	100…150	125…200	200…300	250…400	400 600 800	R, H J, R, HRCII-C L	6.0 25″ W	MCP, LD, HLD	6.0 25″ W
					400, 600, 800	R, H J, R, HRCII-C L			

(1) Adding options may increase the space factor of the unit.

Combination Vacuum Full Voltage Non-reversing Starter Units (FVNR) - Bulletin 2112 and 2113

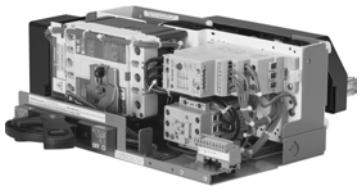
These combination full voltage non-reversing starter units are supplied with an Allen-Bradley Bulletin 1102C contactor and either a fusible disconnect or a circuit breaker. The full voltage non-reversing vacuum starters are rated 200 A, 400 A or 600 A. Each unit is provided as a NEMA Class 1, Type B unit, with terminals mounted in the unit for connection to remote devices. Full voltage non-reversing vacuum starter units are available with a eutectic alloy, E1 Plus or E3 electronic overload relay.

Bulletin 2112 and 2113 Vacuum Full Voltage Non-reversing Starter Unit with Vacuum Contactor and Fusible Disconnect Switch or Vacuum Contactor and Circuit Breaker (FVNR)

Rating (Amperes)	Horsepower					Disconnect Switch Rating (Amperes)	Bulletin 2112			Bulletin 2113	
	208V	240V	380… 415V	480V	600V		Fuse Clip		Space Factor(1)	Circuit Breaker Frame (Amperes)	Space Factor(1)
							Rating (Amperes)	Fuse Class			
200	40…50	40…60	60…100	60…125	60…150	200	100	J, R, H, HRCII-C	3.5	250AF	3.5
							200	J, R, H, HRCII-C			
							400	J			
	60	75	—	150	200	400	200	J, R, H, HRCII-C	4		
							400	J			
400	75…100	100	125…200	200	250…300	400	200	J, R, H, HRCII-C	4.5	250AF	3.5
							400	J, R, H, HRCII-C		400AF	3.5
							600	J		600AF	4
	125	125…150	250	250…300	350…400	600	400	J, R, H, HRCII-C	6.0, 20″W		6.0, 20″W
							600	J			
600	150	—	300	350	—	600	400	J, R, H, HRCII-C	6.0, 20″W	600AF	6.0, 20″W
							600	J			

(1) Adding options may increase the space factor of the unit.

Space Saving NEMA - Combination Full Voltage Non-Reversing Starter Units (FVNR) - Bulletin 2112 and 2113



These combination full voltage non-reversing starter units offer a space saving alternative while utilizing an Allen-Bradley Bulletin 300 starter and either a fused disconnect or a circuit breaker. The Bulletin 2112 Space Saving NEMA non-reversing starter units are rated for NEMA Size 1 applications and the Bulletin 2113 Space Saving NEMA non-reversing starter units are rated for NEMA Size 1 through 4 applications. Each unit is provided as a NEMA Class I, Type B-D unit with terminals mounted in the unit for connections to remote devices. These full voltage non-reversing units are available with E1 Plus or E3 electronic overload relays.

Bulletin 2112 and 2113 - Space Saving NEMA Full Voltage Non-reversing Starter Unit with Fused Disconnect Switch or Circuit Breaker (FVNR)

NEMA Size	Horsepower		Bulletin 2112			Bulletin 2113	
	480V	600V	Fuse Clip		Space Factor(1)	Circuit Breaker Type	Space Factor(1)
			Rating (Amperes)	Class			
1	0.5…10	0.75…10	30	CC, J, HRCII-C	0.5	MCP, I3C, I6C	0.5
2	15…25	15…25	—	—	—		0.5
3	30 …50	30…50	—	—	—		1.0
4	60…100	60…100	—	—	—	MCP, JD3D, JD6D	1.0

(1) Adding options may increase the space factor of the unit.

Combination 2-Speed Starter Units (TS2W and TS1W) - Bulletin 2122E, 2123E, 2122F and 2123F

These combination two-speed starter units are supplied with an Allen-Bradley Bulletin 520 starter and either a fusible disconnect or a circuit breaker. The 2122 and 2123 starter units are designed for use with motors having separate windings or consequent pole windings. The 2122E, 2123E, 2122F and 2123F are rated for NEMA sizes 1 through 5. Each unit is provided as a NEMA Class I, Type B-T unit, with terminals mounted in the unit for connection of remote devices. Two-speed starter units are available with a eutectic alloy, E1 Plus or E3 Plus overload relay.

Bulletin 2122E and 2123E - Two Speed, 2-Winding Starter Unit with Fusible Disconnect Switch or Circuit Breaker(TS2W)

NEMA Size	Constant or Variable Torque Horsepower				Bulletin 2122E			Bulletin 2123E	
	208V	240V	380V…415V	480/600V	Fuse Clip		Space Factor(1)	Circuit Breaker Type	Space Factor(1)
					Rating (Amperes)	Class			
1	0.125…7.5	0.125…7.5	0.125…10	0.125…10	30	CC, J, R, H, HRCII-C	2.0	MCP, MCP-ELC, I3C, I3C-CL, I6C	2.0
					60	J, R, H, HRCII-C			
2	10	10…15	15…25	15…25	30 60 100	J, R, H, HRCII-C J, R, H, HRCII-C J, R, H, HRCII-C	2.0		2.0
3	15…25	20…30	30…50	30…50	60 100 200	J, R, H, HRCII-C J, R, H, HRCII-C J, R, H, HRCII-C	3.0		3.0
4	30…40	40…50	60…75	60…100	100 200 400	J, R, H, HRCII-C J, R, H, HRCII-C J	4.5	MCP, MCP-ELC, JD3D, JD6D	4.5
5	50…75	60…100	100…150	125…200	200 400 600	J, R, H, HRCII-C J, R, H, HRCII-C J	6.0, 20″ W	MCP, JD3D, K3D, JD6D, K6D	6.0, 20″ W

(1) Adding options may increase the space factor of the unit.

2122F and 2123F - Two Speed, 1-Winding Starter Unit with Fusible Disconnect Switch or Circuit Breaker (TS1W)

NEMA Size	Constant or Variable Torque Horsepower				Bulletin 2122F			Bulletin 2123F	
	208V	240V	380…415V	480/600V	Fuse Clip		Space Factor(1)	Circuit Breaker Type	Space Factor(1)
					Rating (Amperes)	Class			
1	0.125…7.5	0.125…7.5	0.125…10	0.125…10	30	CC, J, R, H, HRCII-C	2.0	MCP, MCP-ELC, I3C, I3C-CL, I6C	2.0
					60	J, R, H, HRCII-C			
2	10	10…15	15…25	15…25	30 60 100	J, R, H, HRCII-C J, R, H, HRCII-C J, R, H, HRCII-C	2.0		2.0
3	15…25	20…30	30…50	30…50	60 100 200	J, R, H, HRCII-C J, R, H, HRCII-C J, R, H, HRCII-C	4.0		3.5
4	30…40	40…50	60…75	60…100	100 200 400	J, R, H, HRCII-C J, R, H, HRCII-C J	4.5	MCP, MCP-ELC, JD3D, JD6D	4.5
5	50…75	60…100	100…150	125…200	200 400 600	J, R, H, HRCII-C J, R, H, HRCII-C J	6.0, 25″ W	MCP, JD3D, K3D, JD6D, K6D	6.0, 25″ W

(1) Adding options may increase the space factor of the unit.

Notes:

Metering Units

Metering Compartments - Bulletin 2190

Bulletin 2190 metering units are used for power management of three-phase systems and include analog ammeter and voltmeter, Powermonitor II and Powermonitor 3000 units. The ammeter, voltmeter, digital meter and Powermonitor 3000 units include a 30 A fused disconnect switch.

Bulletin 2190 - Analog Metering Compartments

Meter Type	Description	Line Voltage (Volts)	Space Factor[4]
Door Mounted Analog Ammeter[1]	One current transformer and panel type ammeter.	600 Max.	0.5 or 1.0
Door Mounted Analog Ammeter with Ammeter Switch [1][2]	Two or three current transformers, panel type ammeter and ammeter switch.		0.5 or 1.0
Plug-in Analog Ammeter and Voltmeter with Switches[2][3]	Two or three current transformers, panel type ammeter with ammeter switch, two (2) fused potential transformers and panel type voltmeter with voltmeter switch.	208…600	1.0

(1) No disconnect means, no unit insert
(2) Use on 3-phase, 3-wire systems only
(3) Units with disconnect and fuses
(4) Adding options may increase the space factor of the unit.

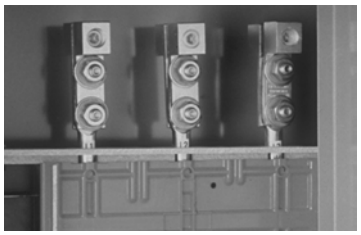
Bulletin 2190 - Digital Metering Compartments

Meter Type	Description	Space Factor[2]
Powermonitor 3000, (Bulletin 1404-M5), with RS-485 Communications	Plug-in unit with disconnect, fuses, and control circuit transformer. Fused potential transformers are self-contained in the meter's power module.	1.0
Powermonitor 3000, (Bulletin 1404-M6) with RS-485 Communication		
Digital Volt and Ammeter, (Bulletin 1405-M610) [1]	Plug-in metering unit with disconnect and fuses.	0.5

(1) For use on 3-phase, 3-wire systems only
(2) Adding options may increase the space factor of the unit.

Notes:

Main and Feeder Units



Outgoing Feeder Lug Compartment (FLUG) and Incoming Main Lug Compartment (MLUG) - Bulletin 2191F and 2191M

Line lug compartments provide a lug connection for incoming lines (2191M) to distribute power to the CENTERLINE 2100 MCC or for outgoing cables (2191F) to feed power from the MCC to an external load. These line lug compartments are available with ratings from 300…2000 A. Optional mechanical or crimp lugs can be supplied with the lug compartments.

Bulletin 2191M and 2191F - Lug for Basic Sections

Rating (Amperes)	Cable Provisions Maximum Number Per Phase and Maximum Cable Size			Space Factor[1]	Feeder (Bulletin 2191F)		Main (Bulletin 2191M)	
	Mechanical Type Lugs		Crimp Type Lugs		Top	Bottom	Top	Bottom
	Single Cable Lug	Multiple Cable Lug						
300	(2) 400 kcmil	—	(2) 350 kcmil	1.0	x	x		
				1.0			x	x
600	(2) 400 kcmil	(4) 250 kcmil	(2) 350 kcmil	1.0	x	x		
				1.0			x	x
	(1) 500 kcmil	(2) 300 kcmil	(2) 350 kcmil	In top, horizontal wireway			x	x
	(2) 750 kcmil	(4) 500 kcmil	(1) 750 kcmil (2) 500 kcmil	1.5			x	x
	(4) 800 kcmil	—	(4) 750 kcmil	6.0, 20″ W	x	x	x	x
800	(2) 800 kcmil (4) 600 kcmil	—	(2) 750 kcmil (4) 500 kcmil	1.0	x[2]		x[2]	
	(1) 750 kcmil (2) 600 kcmil (4) 500 kcmil	—	(3) 500 kcmil (4) 350 kcmil	1.5	x	x	x	x
	(1) 800 kcmil (2) 750 kcmil (4) 600 kcmil	—	(2) 750 kcmil (4) 500 kcmil	2.0	x	x	x	x
800	(4) 800 kcmil	—	(4) 750 kcmil	6.0 , 20″ W	x	x	x	x
1200	(2) 800 kcmil (4) 600 kcmil	—	(2) 750 kcmil (4) 500 kcmil	1.0	x		x	
	(1) 800 kcmil (2) 750 kcmil (4) 600 kcmil	—	(2) 750 kcmil (4) 500 kcmil	2.0	x	x	x	x
1200	(4) 800 kcmil	—	(4) 750 kcmil	6.0, 20″ W	x	x	x	x
1600		—			x	x	x	x
2000	(6) 800 kcmil	—	(6) 750 kcmil		x	x	x	x

(1) Adding options may increase the space factor of the unit.
(2) Requires pull-box to meet N.E.C. bending space requirements

Lug Compartments for Inside Corner, 10” Wide Sections and Neutrals/Incoming Line and Outgoing Feeders

Rating (Amperes)	Cable Provisions Maximum Number Per Phase and Maximum Cable Size		Space Factor[1]
	Mechanical Type Lugs		
	Single Cable Lug	Crimp Type Lugs	
INSIDE CORNER SECTION			
600…2000	(4) 800 kcmil	(4) 750 kcmil	6.0
10” WIDE SECTION			
600…1200	Not Applicable	(2) 750 kcmil (4) 500 kcmil	6.0

(1) Adding options may increase the space factor of the unit.

Lug Compartments/Incoming Lines Metering Options

Meter Type[1]	Description	
Analog Ammeter	Includes one current transformer and panel type ammeter.	Current transformers shipped loose with hardware and mounting instructions
Analog Ammeter with Ammeter Switch	Includes two current transformers, panel type ameter, and ammeter switch. Use on three-phase, three-wire systems only.	
	Includes three current transformers, panel type ammeter, and ammeter switch. Use on three-phase, three-wire systems only.	
Analog Voltmeter	Includes one fused potential transformers (mounted in a compartment) and panel-type voltmeter.	
Analog Voltmeter with Voltmeter Switch	Includes two fused potential transformers (mounted in a compartment), panel-type voltmeter, and voltmeter switch. For three-phase, three-wire systems only.	
Analog Ammeter and Voltment with Switches	Two current transformers, panel type ammeter with ammeter switch, two fused potential transformers, and panel type voltmeter with voltmeter switch.	Current transformers shipped loose with hardware and mounting instructions. Use on three-phase, three-wire systems only.
	Three current transformers, panel type ammeter with ammeter switch, two fused potential transformers, and panel type voltmeter with voltmeter switch.	
Bulletin 1404-M5 Powermonitor 3000 with RS-485 Communication[2]	Display module mounted on door. Includes control circuit transformer. For three-phase, three-wire systems, three current transformers ship loose with hardware and mounting instructions. For three-phase, four-wire systems, four current transformers ship loose with hardware and mounting instructions. Disconnect switch is not included.	
Bulletin 1404-M6 Powermonitor 3000 with RS-485 Communication[2]		
Bulletin 1405-M610 Digital Volt/ Ammeter	For use on three-phase, three-wire systems only. Plug-in metering unit with disconnect and fuses. Current transformers shipped loose with hardware and mounting instructions. Potential transformers are internal to the device.	

(1) Metering not available in 2191M 600 A main lugs in horizontal wireway.
(2) For three-wire power systems where L1-N, L1-G, L2-N, L2-G, L3-N, or L3-G may exceed 347V. Contact your local authorized Allen-Bradley distributor or Rockwell Automation Sales Office for more information.

Feeder and Main Fusible Disconnect Switch Units (FDS, MFDS) - Bulletin 2192F and 2192M

These switches are available with ratings from 30…2000 A. The 2192F is a plug-in unit for ratings up to 200 A and frame mounted for ratings 400 A and above. The 2192M is frame mounted (rigidly mounted and hardwired) in the structure for all ratings. The bolted pressure switch design is used for 2192 units rated 600…2000 A.

Select disconnect switch rating based upon 125% of actual load amperes.

Bulletin 2192F Fusible Disconnect Switch—Feeders (FDS)

Switch Rating (Amperes)	Fuse Clip		Load Lugs Provided			Space Factor[1]
	Rating (Amperes)	Class	Cables/ Phase	Cable/Wire Size Range	Wire Type	
30	30	CC, J	1	#14-#8 AWG	CU	0.5
30	30	CC, J, R, H		#14-#4 AWG		1.0
60	60	J, R, H				1.0
Dual 30	30					
Dual 60/30	60/30					
Dual 60	60					
Dual 100/30	100/30			#14-1/0 AWG #14-4 AWG		1.5
Dual 100/60	100/60					
Dual 100	100			#14-1/0 AWG		
100	100			#8-1/0 AWG		
200	200			#6-4/0 AWG		2.0
400	400		2	#1/0-250 kcmil		2.5
600	600	J, R, H, L	2	#2-600 kcmil	CU/AL	3.5
800	800	L	3	#6-350 kcmil		3.5
1200	1200		4	#6-350 kcmil		3.5

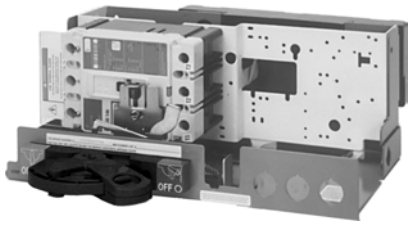
(1) Adding options may increase the space factor of the unit.

Bulletin 2192M Fusible Disconnect Switch—Mains (MFDS)

Switch Rating (Amperes)	Fuse Clip		Line Lugs Provided			Space Factor[1]
	Rating (Amperes)	Class	Cables/Phase	Cable/Wire Size Range	Wire Type	
30	30	J, R, H	1	#14-#8 AWG	CU	1.5
60	60		1	#14-#6 AWG	CU	
100	100		1	#8-1/0 AWG	CU	
200	200		1	#6-4/0 AWG	CU	2.0
400	400		2	1/0-250 kcmil	CU	2.5
600	600	J, R, H, L	2	#2-600 kcmil	CU/AL	3.5
800	800	L	3	#6-350 kcmil	CU/AL	
1200	1200		4	#6-350 kcmil	CU/AL	
1600	1600		4	#2-600 kcmil	CU/AL	6.0, 20″ D, 35″ W
2000	2000		6	#2-600 kcmil	CU/AL	

(1) Adding options may increase the space factor of the unit.

Feeder and Main Circuit Breaker Units (FCB, MCB) - Bulletin 2193F and 2193M



Bulletin 2193F and 2193M are circuit breaker units with trip ratings available from 15…2000 A. These units are available with thermal magnetic trips up to 400 A and electronic trips 600 A and above. The 2193F is a plug-in unit for ratings up to 225 A and is a frame mounted unit for ratings 400 A and above. The 2193M is frame mounted for all ratings.

Bulletin 2193F 3-Pole Feeder Circuit Breaker (FCB)

Frame		Range of Available Trips (Amperes)	Interrupting Capacity Ratings (rms symmetrical Amperes)			Space Factor[1]
Rating (Amperes)	Type		208V/240V	380V/400V 415V/480V	600V	
150	I3C	15…100	65k	35k	18k	0.5
	I6C		100k	65k	25k	
	I0C	15…50	100k	100k	35k	
		60…100				
	I3C-CL	15…50	100k	100k	100k	
		60…100				
	I3C	125…150	65k	35k	18k	
	I6C		100k	65k	25k	
	I0C		100k	100k	35k	
	I3C-CL		100k	100k	100k	
	I3C	15…100	65k	35k	18k	1.0
	I6C		100k	65k	25k	
	I0C	15…50	100k	100k	35k	
		60…100				
	I3C-CL	15…50	100k	100k	100k	1.0
		60…100				1.5
	I3C	125…150	65k	35k	18k	1.0
	I6C		100k	65k	25k	
	I0C		100k	100k	35k	
	I3C-CL		100k	100k	100k	1.5
225	JD3D	70 , 90…225	65k	35k	18k	0.5
	JD6D		100k	65k	25k	
	JD0D		100k	100k	35k	
	JD3D		65k	35k	18k	1.5
	JD6D		100k	65k	25k	
	JD0D		100k	100k	35k	
400	K3D	125…400	65k	35k	25k	2.0
	K6D		100k	65k	35k	
	K0D		100k	100k	65k	

(1) Adding options may increase the space factor of the unit.

Bulletin 2193F 3-Pole Feeder Circuit Breaker (FCB), continued

Frame		Range of Available Trips (Amperes)	Interrupting Capacity Ratings (rms symmetrical Amperes)			Space Factor[1]
Rating (Amperes)	Type		208V/240V	380V/400V 415V/480V	600V	
600	LD	300…600	65k	35k	25k	2.0
	HLD		100k	65k	35k	
	LDC		100k	100k	50k	
800	MDL	400…800	65k	50k	25k	2.5
	HMDL		100k	65k	35k	
	NDC		100k	100k	65k	
1200	ND	600…1200	65k	50k	25k	3.5
	HND		100k	65k	35k	
	NDC		100k	100k	65k	

(1) Adding options may increase the space factor of the unit.

Bulletin 2193M 3-Pole Main Circuit Breaker (MCB)

Frame		Range of Available Trips (Amperes)	Interrupting Capacity Ratings (rms symmetrical Amperes)			Space Factor[1]
Rating (Amperes)	Type		208V/240V	380V/400V 415V/480V	600V	
150	I3C	15…100	65k	35k	18k	1.5
	I6C		100k	65k	25k	
	I0C	15…50	100k	100k	35k	
		60…100				
	I3C-CL	15…50	100k	100k	100k	
		60…100				
	I3C	125…150	65k	35k	18k	
	I6C		100k	65k	25k	
	I0C		100k	100k	35k	
	I3C-CL		100k	100k	100k	
225	JD3D	70, 90…225	65k	35k	18k	
	JD6D		100k	65k	25k	
	JD0D		100k	100k	35k	
400	K3D	125…400	65k	35k	25k	2.0
	K6D		100k	65k	35k	
	K0D		100k	100k	65k	
600	LD	300…600	65k	35k	25k	
	LDG		65k	35k	25k	
	HLD		100k	65k	35k	
	HLDG		100k	65k	35k	
	LDC		100k	100k	50k	
	LDCG		100k	100k	50k	
	LD HI-MAG	600	65k	35k	25k	

(1) Adding options may increase the space factor of the unit.

Bulletin 2193M 3-Pole Main Circuit Breaker (MCB), continued

Frame		Range of Available Trips (Amperes)	Interrupting Capacity Ratings (rms symmetrical Amperes)			Space Factor[2]
Rating (Amperes)	Type		208V/240V	380V/400V 415V/480V	600V	
800	MDL	400…800	65k	50k	25k	2.5
	MDLG		65k	50k	25k	
	HMDL		100k	65k	35k	
	HMDLG		100k	65k	35k	
	NDC		100k	100k	65k	
	NDCG		100k	100k	65k	
	MDL HI-MAG	800	42k	35k	22k	
1200	ND	600…1200	65k	50k	25k	3.5
	NDG		65k	50k	25k	
	HND		100k	65k	35k	
	HNDG		100k	65k	35k	
	NDC		100k	100k	65k	
	NDCG		100k	100k	65k	
	ND HI-MAG	1200	65k	50k	25k	
2000[1]	RD	1200…2000	100k	65k	50k	6.0, 30″ W, 20″ D
	RDG		100k	65k	50k	

(1) These units only can be used on systems of 65kA available or less. If 100kA is required, contact your local authorized Allen-Bradley distributor or Rockwell Automation Sales Office.
(2) Adding options may increase the space factor of the unit.

Lighting and Power Panel Units

Lighting Panel (LPAN) - Bulletin 2193LE

Bulletin 2193LE is a frame mounted lighting panel with either a main lug or main circuit breaker. The lighting panels are rated for 100 A or 225 A with up to 42 branch circuits. One, two and three pole bolt-on branch circuit breakers are available with ratings from 15…100 A.

Bulletin 2193LE Frame Mounted Lighting Panel for Bolt-on Branch Circuit Breakers (LPAN)

Type	Panel Bus and Main Lug Ampere Rating	Max. Number of 1-pole Circuit Breakers	Space Factor[3]
Single Phase 3-Wire 120/240V AC 10kA IC rms Sym.[1]	100	18	2.0
	225	30	2.5
		42	3.0
Three Phase 4-Wire 120/208V AC 10kA IC rms Sym.[1]	100	18	2.0
		30	2.5
	225	42	3.0
Single Phase 3-Wire 120/240V AC.[2]	100	16	2.0
	225	30	3.5
		42	4.0
Three Phase 4-Wire 120/208V AC.[2]	100	15	2.0
		27	2.5
	225	42	4.0

(1) With Main Lug Only (MLO)
(2) With Main Circuit Breaker (MCB) 100 A Main Circuit Breaker is Cutler-Hammer BAB type series rating 10 kA. 225 A Main Circuit Breaker is Cutler-Hammer ED type series rating 65kA.
(3) Adding options may increase the space factor of the unit.

Panel Board with Main Circuit Breaker (PPAN) - Bulletin 2193PP

Bulletin 2193PP is a plug-in unit panel board with a main circuit breaker. The panel boards are rated for 100 A, 150 A or 225 A with up to 42 branch circuits. One, two and three pole bolt-on branch circuit breakers are available with ratings from 15…100 A. The Bulletin 2193PP panel board is suitable for use with 3-phase, 4-wire, solidly grounded, Wye systems rated 480Y/277V or less. IT may also be used on solidly grounded 3-wire power systems, however, only 2-pole and 3-pole branch circuit breakers can be used.

Bulletin 2193PP Plug-in Panel Board with Main Circuit Breaker (PPAN)

Main Breaker Trip Rating (Amperes)	Max. Number of 1-pole Circuit Breakers	Main Circuit Breaker Type	Space Factor[1]	IC Rating at 480Y/ 277V (rms Sym.)[2]
100	18	I3C	2.5	25kA
		I6C		65kA
		I0C		100kA
150	30	I3C	3.0	25kA
		I6C		65kA
		I0C		100kA
	42	I3C	3.5	25kA
		I6C		65kA
		I0C		100kA
225	18	JD3D	3.5	35kA[3]
	30			
	42		4.0	

(1) Adding options may increase the space factor of the unit.
(2) This rating can be applied to all branch circuit breakers.
(3) 35kA series combination rating only when used with 50 A or lower rated branch circuit breakers. Series combination rating is 22kA when used with branch circuit breakers rated 60 A or higher.

Transformer Units

Control and Lighting Transformers without Disconnecting Means (XFMR) - Bulletin 2195
Control and Lighting Transformers with Fusible Disconnect Switch (XFMR) - Bulletin 2196
Control and Lighting Transformers with Circuit Breaker (XFMR) - Bulletin 2197

The transformer units are available with ratings from 0.5…50 kVA for single-phase and 10…45 kVA for three-phase. Secondary fuses are provided with each transformer unit. Factory installed primary fusing is optional on the Bulletin 2196 transformer unit.

Control and Lighting Transformer Unit (XFMR)

Rating kVA	Recommended Primary Protection (Amperes)			Bulletin 2195 Space Factor[8]	Bulletin 2196 Space Factor[8]	Bulletin 2196Z Space Factor[8]	Bulletin 2197 Space Factor[8]	Bulletin 2197Z Space Factor[8]
	240V	480V	600V					
SINGLE PHASE—120 Volt secondary with one secondary fuse								
0.5	15[1]	15[1]	15[1]	1.0	1.0	—	1.0	—
0.75								
1				1.5	1.5		1.5	
1.6				2.0	2.0		2.0	
2								
3 (1.5)				1.5	2.5	2.0	2.5	2.0
5 (2.5)	—	—						
SINGLE PHASE—120/240 Volt secondary with two secondary fuses Transformer secondary wired and protected for 240V phase to phase/120V phase to center tap neutral.								
5 (2.5)	30	15[1]	—	1.5	2.5	2.0	2.5	2.0
7.5 (3.7)	40[2]	20[1]	20[1]					
10 (5)	50[2]	30	20[1]					
15 (7.5)	70	40[4]	30[4]	2.0	3.0	—	3.0	2.5
25 (12.5)	125	70[4]	60					
37.5 (18.5)	200	100	70[6]	2.0 , 20″ D	3.5, 20″ D		3.0, 20″ D	2.5, 20″ D
50 (25)	300[3]	150[5]	100					
THREE PHASE—120/208 Volt secondary with three secondary fuses Transformer secondary wired and protected for 208V phase to phase/120V phase to WYE neutral.								
10 (5)	—	20[1]	15[1]	2.0	3.0	2.5	3.0	2.5
15 (7.5)	—	20[1]	15[1][7]					
25 (12.5)	—	40[4]	30[4]			—		
30 (15)	—	50[4]	40[4]					
37.5 (18.5)	—	60	50[4]	2.0 , 20″ D	3.0, 20″ D		3.0, 20″ D	2.5, 20″ D
45 (22.5)	—	70[6]	60					

(1) 30 A fuse clip rating for Bulletin 2196 and 2196Z
(2) 60 A fuse clip rating for Bulletin 2196 not available for Bulletin 2196Z
(3) Not available for Bulletin 2196, 2197 and 2197Z
(4) 60 A fuse clip rating for Bulletin 2196
(5) 200 A fuse clip rating for Bulletin 2196
(6) 100 A fuse clip rating for Bulletin 2196
(7) 20 A circuit breaker rating for Bulletin 2197 and 2197Z
(8) Adding options may increase the space factor of the unit

Control and Lighting Transformer Unit, continued

Rating kVA[1]	Recommended Primary Protection (Amperes)			Bulletin 2195 Space Factor[4]	Bulletin 2196 Space Factor[4]	Bulletin 2196Z Space Factor[4]	Bulletin 2197 Space Factor[4]	Bulletin 2197Z Space Factor[4]
	380V	400V	415V					
SINGLE PHASE—110/115 Volt secondary with one 1-pole circuit breaker								
0.5	15[2]	15[2]	15[2]	1.0	1.0	—	1.0	—
0.75								
1				1.5	1.5		1.5	
1.6				2.0	2.0		2.0	
2								
3 (1.5)				1.5	2.5	2.0	2.5	2.0
SINGLE PHASE—110/220 Volt secondary with two 1-pole circuit breakers Transformer secondary wired and protected for 220V phase-to-phase, 110V phase-to-center tap neutral.								
5 (2.5)	20[2]	—	—	1.5	2.5	2.0	2.5	2.0
7.5 (3.7)	20[2]	—	—					
10 (5)	30[2]	—	—					
15 (7.5)	50[3]	—	—	2.0	3.0	—	3.0	2.5
SINGLE PHASE—115/230 Volt secondary with two 1-pole circuit breakers Transformer secondary wired and protected for 230V phase-to-phase, 115V phase-to-center tap neutral.								
5 (2.5)	—	20[2]	—	1.5	2.5	2.0	2.5	2.0
7.5 (3.7)	—	20[2]	—					
10 (5)	—	30	—					
SINGLE PHASE— 120/240 Volt secondary with two 1-pole circuit breakers Transformer secondary wired and protected for 240V phase-to-phase, 120V phase-to-center tap neutral.								
5 (2.5)	—	—	20[2]	1.5	2.5	2.0	2.5	2.0
7.5 (3.7)	—	—	20[2]					
10 (5)	—	—	30					
15 (7.5)	—	—	50[3]	2.0	3.0	—	3.0	2.5

(1) In NEMA Type 12 applications (non-ventilated 3 kVA and larger transformers), to maximize the transformer's life, we recommend that the transformer not be loaded to greater than 50% of its nameplate rating. Number in parentheses indicates approximate derated rating. However, in many applications, NEMA Type 1 with gasket design (vented and filtered doors) may be sufficient.
(2) 30 A fuse clip rating for Bulletin 2196 and 2196Z
(3) 60 A fuse clip rating for Bulletin 2196
(4) Adding options may increase the space factor of the unit

Miscellaneous Units

Full section blank mounting plates are six space factors in size. They are available with no disconnect means, fusible disconnect switch or circuit breaker. They are also available with or without the horizontal bus.

Blank unit doors are available in a range of space factors from 0.5…4.0 in 0.5 space factor increments. The blank unit doors cover the unused unit space and have a unit support pan.

Empty Unit Inserts

Description		Space Factor[1]
Empty Unit Insert	For field installed equipment. 8.625 in. working depth with no plug-in stabs. Inserts come with unit support pan and door. Inserts are NOT UL listed and are NOT CSA certified.	0.5…4.0 (in 0.5 space factor increments)
Empty Unit Insert with Disconnecting Means	For field installed equipment. 8.625 in. working depth and includes fusible disconnect and plug-in stabs. Inserts come with unit support pan and door. Adding equipment to this unit insert may require field evaluation by UL/CSA in order to retain listing/certification.	1.5…4.0 (in 0.5 space factor increments)
	For field installed equipment. 8.625 in. working depth, includes inverse time (thermal magnetic) circuit breaker and plug-in stabs. Inserts come with unit support pan and door. Adding equipment to this unit insert may require field evaluation by UL/CSA in order to retain listing/certification.	1.5…4.0 (in 0.5 space factor increments)

(1) Adding options may increase the space factor of the unit

DeviceNet Units

Description		Space Factor[1]
DeviceNet Power Supply Unit (110…120V AC input and 8.0 A, 24V DC output)	Without disconnection means, plug-in stabs or control circuit transformer. Requires separate 110…120V AC source.	0.5
	Includes disconnect, fuses and 350VA control circuit transformer to provide power to power supply.	1.0
	Includes circuit breaker, fuses and 350VA control circuit transformer to provide power to power supply.	
Redundant DeviceNet Power Supply Unit (110…120V AC input and 8.0 A, 24V DC output)	Without disconnection means, plug-in stabs or control circuit transformer. Requires separate 110…120V AC source.	1.0
	Includes disconnect, fuses and 750VA control circuit transformer to provide power to power supply.	1.5
	Includes circuit breaker, fuses and 750VA control circuit transformer to provide power to power supply.	
ControlNet to DeviceNet linking device (Bulletin 1788)	Without disconnecting means, plug-in stabs, or control circuit transformer. Requires separate 110…120V AC source. Viewing window in door to provide visual verification of network status.	0.5
	With disconnect, fuses, and 80VA control circuit transformer. Viewing window in door to provide visual verification of network status.	1.0
	With circuit breaker, fuses, and 80VA control circuit transformer. Viewing window in door to provide visual verification of network status.	
Ethernet to DeviceNet linking device (Bulletin 1788)	Without disconnecting means, plug-in stabs or control transformer. Requires separate 110…120V AC source. Viewing window in door to provide visual verification of network status.	0.5
	With fusible disconnect and 80VA control transformer. Viewing window in door to provide visual verification of network status.	1.0
	With circuit breaker and 80VA control transformer. Viewing window in door to provide visual verification of network status.	
External DeviceNet Connector Unit with remotely powered 120V AC receptacle	Door mounted external DeviceNet connection and 120V AC receptacle for connection of computer to DeviceNet without having to open doors.	0.5

(1) Adding options may increase the space factor of the unit

Miscellaneous Units

Description				Space Factor[2]
NEMA Type "C" Terminal Board Unit (supplied unwired)	Includes Bulletin 1492-CA1 terminal blocks	Top or bottom-mounted	44 Terminal Blocks	1.0
			66 Terminal Blocks	
			88 Terminal Blocks	
			110 Terminal Blocks	
		Top or bottom-mounted	76 Terminal Blocks	1.5
			114 Terminal Blocks	
			152 Terminal Blocks	
			190 Terminal Blocks	
Neutral Connection Plate Unit	0.25 in. x 2 in. x 12 in. copper tin plated bus plate with #6-250 kcmil lug (280 A capacity)			0.5
	0.25 in. x 2 in. x 12 in. copper silver plated bus plate with #6-250 kcmil lug (280 A capacity)			0.5
Surge Protective Device Unit (formerly known as TVSS)[1]	WYE power systems with a solidly grounded neutral 3-wire	480V L-L, 277V L-G		0.5
		600V L-L, 346V L-G		
		208V L-L, 120V L-G		
		380V L-L, 220V L-G		
		400V L-L, 230V L-G		
		415V L-L, 240V L-G		
	WYE power systems with a solidly grounded neutral, 4-wire	480V L-L, 277V L-G, 277V L-N		
	WYE power systems with impedence grounded neutral or 3 Phase, 3-Wire Delta Power Systems	480V		
		600V		
		240V		
		380V		
		400V		
		415V		
Corner Section	Inside corner configuration is either 15 in. deep by 25 in. wide or 20 in. deep by 30 in. wide and is designed to contain power bus rated 600…2000 A only. There is no available space for the installation of units. The corner section does not have vertical wireway. Not available in either NEMA Type 3R, Type 4 or back-to-back construction.			6.0

(1) Refer to Surge Protective Device Unit, publication 2100-TD023, for more information
(2) Adding options may increase the space factor of the unit

Miscellaneous Unit Options

Pilot Devices

Option	Description	FVC	FVR	FVNR	TS1W TS2W
		2102L 2103L	2106 2107	2112 2113	2122 2123
Push Buttons	Start - Stop			✓	
	Forward - Reverse - Stop		✓		
	High - Low - Stop				✓
	Off	✓			
	Stop		✓	✓	✓
	On - Off	✓			
	Fast - Slow - Stop				✓
Push Buttons and Selector Switch	Hand-On, Hand-Off, Hand-Off-Auto	✓			
	Hand-Start, Hand-Stop, Hand-Off-Auto			✓	
Control Station Housing	Blank	✓	✓	✓	✓
	1 hole—for one pilot device	✓	✓	✓	✓
	2 holes—for two pilot devices	✓	✓	✓	✓
	3 holes—for three pilot devices	✓	✓	✓	✓
	4 holes—for four pilot devices	✓		✓	
Selector Switch (800H) (maximum one switch per unit)	Hand - Off - Auto	✓		✓	
	Forward - Off - Reverse		✓		
	High - Off - Low				✓
	Forward - Off - Reverse and High - Low				
	High - Low - Off - Reverse				
	Fast - Off - Slow				✓
	Off - On	✓		✓	
	Forward - Off - Reverse and Fast - Slow				
	Fast - Slow - OFF - Reverse				

Pilot Lights (Non-push-to-test and Push-to-test)

Description	FVC	FVR	FVNR	TS1W TS2W
	2102L 2103L	2106 2107	2112 2113	2122 2123
On	✓			
On - Off	✓			
Forward - Reverse		✓		
Forward - Reverse - Off		✓		
On			✓	
On - Off			✓	
High - Low				✓
Fast - Slow				✓
High - Low - Off				✓
Fast - Slow - Off				✓
High - Low - Forward - Reverse				
Fast - Slow - Forward - Reverse				
High - Low - Forward - Reverse - Off				
Fast - Slow - Forward - Reverse - Off				
Overload		✓	✓	✓

Control Circuit Transformer (with grounded and fused secondary)

Description	Size or Rating	FVC	Size or Rating	FVR	FVNR	TS1W TS2W
		2102L 2103L		2106 2107	2112 2113	2122 2123
		VA		VA	VA	VA
Standard capacity with primary fusing	30A	80	1	80	80	80
	60A	80	2	80	80	80
	100A	200	3	200	200	200
	200A	250	4	250	250	250
	300A	350	5	350	350	350
	—	—	6	—	80	—
	—	—	200A and 400A	—	250	—
	—	—	600A	—	500	—
100 watt extra capacity with primary fusing	30A	130	1	130	130	130
	60A	130	2	130	130	130
	100A	250	3	250	250	250
	200A	350	4	350	350	350
	300A	500	5	500	500	500
	—	—	6	—	130	—
	—	—	200A and 400A	—	350	—
	—	—	600A	—	750	—

E1 Plus Electronic Overload Relay

Option	Description		FVR	FVNR	TS1W TS2W
			2106 2107	2112 2113	2122 2123
E1 Plus Electronic Overload Relay	Selectable trip class (10, 15, 20, 30) selectable Auto/ Manual-Auto reset electronic overload relay for NEMA starters, Size 1-6.	NEMA Size 1, 2	✓	✓dual	✓
		NEMA Size 3	✓	✓	✓
		NEMA Size 4, 5	✓	✓	
		NEMA Size 6		✓	
	Vacuum Contactor Starters	200A, 400A, 600A		✓	
E1 Plus Electronic Overload Relay with DeviceNet module	Selectable to class (10, 15, 20, 30) selectable Auto/ Manual-Auto reset electronic overload relay NEMA starters, Size 1-6. Includes DeviceNet module with (2) 24VDC inputs and (1) 110-240V AC output.	NEMA Size 1, 2		✓dual	✓
		NEMA Size 3		✓	✓
		NEMA Size 4…6		✓	
	Vacuum Contactor Starters	200A, 400A, 600A		✓	
E1 Plus Electronic Overload Relay with Ground Fault Protection Module & Jam Protection	Selectable to class (10, 15, 20, 30) selectable Auto/ Manual-Auto reset electronic overload relay for NEMA starters, Size 1-3. Includes Ground Fault Protection Module with integral Jam Protection and external Ground Fault Sensor.	NEMA Size 1…6	✓	✓	
	Vacuum Contactor Starters	200A		✓	
		400A, 600A		✓	
E1 Plus with Jam Protection Module	Selectable trip class (10, 15, 20, 30) selectable Auto/ Manual-Auto reset electronic overload relay for NEMA starters, size 1-6 with Jam Protection Module	NEMA Size 1, 2	✓	✓dual	✓
		NEMA Size 3	✓	✓	✓
		NEMA Size 4, 5	✓	✓	
		NEMA Size 6		✓	
	Vacuum Contactor Starters	200A, 400A, 600A		✓	

E3 Electronic Overload Relay[1]

Description		FVR	FVNR
		2106 2107	2112 2113
E3 Basic is provided with two (2) 24V DC inputs and one (1) 110…240V AC output.	NEMA size 1…6		✓
	Vacuum Contactor Starters		✓
E3 Plus is provided with four (4) 24V DC inputs and two (2) 110…240V AC outputs.	NEMA size 1…5	✓	✓
	NEMA size 6		✓
	Vacuum Contactor Starters		✓
E3 Plus with voltage protection and energy monitoring.	NEMA size 1…5	✓	✓
	NEMA size 6		✓
	Vacuum Contactor Starters		✓

(1) For non-DeviceNet applications a 24V DC separate power source is needed. A Bulletin 193-DNCT, may be needed for programming and monitoring.

Miscellaneous Options

Option	Description		FVC	FVR	FVNR	TS1W TS2W	Feeder/ Main
			2102L 2103L	2106 2107	2112 2113	2122 2123	2192 2193
Overload Relay Auxiliary Contact (Eutectic Alloy) (one contact per overload relay)	Normally Open	Type A Wiring		✓	✓	✓	
		Type B Wiring		✓	✓	✓	
	Normally Closed	Type A Wiring		✓	✓	✓	
		Type B Wiring		✓	✓	✓	
DeviceNet Starter Auxiliary (DSA)	For use with contactors and starters to provide DeviceNet inputs and outputs. Four 120V inputs and two 120V outputs. Available for 110…120V control only.		✓	✓	✓	✓	✓
	For use with contactors and starters to provide DeviceNet inputs and outputs. Four 24V DC inputs and Two 240V AC (max), 30V DC (max) outputs. Available for 110…120V AC or 220…240V AC control voltage.		✓	✓	✓	✓	✓
Additional Unit Space	Adds 0.5 space factor unit space to Bulletin 2112 and 2113 size 1, 2 and 3 units.			✓	✓		
Filters for Door Vents	Filters for door vents on NEMA Type 1 and NEMA Type 1 with gasket Bulletin 2195, 2196 and 2197 units		Available on NEMA Type 1 and NEMA Type 1 with gasket Bulletins 2195, 2196 and 2197 only				
Surge Suppressor	On coil, one per contactor, for starters and contactors, not available on vacuum type		✓	✓	✓	✓	
	For units with interposing relays and unwired control relays		✓	✓	✓	✓	
O/L Contact on Left Side of Circuit	Moves overload trip contact from right (grounded) side of the control circuit to left (power input) side of control circuit.			✓	✓	✓	
Omit Wiring	Omission of control wiring		✓	✓	✓	✓	
Control Circuit Fuse	One (1) control circuit fuse for separate control or line to neutral control		✓	✓	✓	✓	
	Two (2) control circuit fuses for common control		✓	✓	✓	✓	

Miscellaneous Options

Option	Description		FVNR
			2112 2113
Blown Fuse Indicator Lights	Option is valid only when 480V and 600V Power Factor Correction Capacitor is selected		✓
480V and 600V Power Factor Correction Capacitors	2 kVAR through 40 kVAR in 0.5 space factor. 42.5 kVAR through 50 kVAR in 1.0 space factor. These capacitors should not be used on motors subject to plugging or jogging. Do not subject capacitors to repetitive switching where capacitors and motors might be reenergized too quickly after being de-energized. Do not install capacitors in any vertical section that contains a variable frequency drive. Capacitors are mounted in separate unit with a separate door. This unit is located below selected starter. Door interlock is included. Three phase power fuses are included. Capacitors are factory wired to load side of the contactor and on the line side of the overload relay.	2…50 kVAR	✓

Miscellaneous Options

Option	Description		FVC	FVR	FVNR	TS1W TS2W
			2102L 2103L	2106 2107	2112 2113	2122 2123
Grounded Unit Door	Hinge mounted ground strap mounted on bottom hinge of unit door. Unit door hinge grounding strap for IEC requirements.		Available on all units			
Unit Load Connector	Select on all plug-in units in sections with vertical unit load ground bus.	Unplated copper	Available on all plug-in units			
		Tin plated copper				
Unit Ground Stab	Copper unit ground stabs also may be used with steel vertical ground bus. Select on plug-in units in sections with vertical plug-in ground bus.	Copper alloy	Available on all plug-in units			
		Unplated copper				
		Tin plated copper				
Thermistor Protection Relay	Bulletin 817-E2P, 110 - 120VAC, 50-60 Hz, output is unwired.				✓	
Unit Ammeter	Analog ammeter and current transformer.			✓	✓	
	Current transformer only for use with external meter. Current transformer rated 2.5VA or greater.			✓	✓	
Elapsed Time Meter	Six digit non-resettable meter (with tenths), mounted in control station		✓		✓	
Unwired Timer Auxiliary (not available on 0.5 SF units)	Bulletin 596 time delay addition to NEMA size 1 through 5 contactors with N.O. and N.C. contacts. Not available with -7FEC_ E3.	On delay			✓	
		Off delay			✓	

Miscellaneous Options

Option	Description		FVC	FVR	FVNR	TS1W TS2W
			2102L 2103L	2106 2107	2112 2113	2122 2123
Ground Detection Lights	Three (3) Bulletin 800T pilot lights (clear), wired in grounded WYE, complete with fusing.	240 Volt	Available on Bulletin 2191M, 2192M and 2193M ONLY Not for use with solidly grounded power systems			
		480 Volt				
		600 Volt				
		208 Volt				
		415 Volt				
		400 Volt				
		380 Volt				
	Three (3) Bulletin 800T push-to-test pilot lights (clear), wired in grounded WYE, complete with fusing.	240 Volt	Available on Bulletin 2191M, 2192M and 2193M ONLY Not for use with solidly grounded power systems			
		480 Volt				
		600 Volt				
		208 Volt				
		415 Volt				
		400 Volt				
		380 Volt				
Ground Fault Protection	Integral ground fault protection system with adjustable pick-up, adjustable time delay, control power indicator light, trip indicator and built-in test feature. Shunt trip is included.		Only available on Bulletin 2192M, 1600A-2000A. For use with solidly grounded WYE systems only			

Miscellaneous Options

Option	Description	Rating	Main Neutral Bus Location			Space Factor Adder			MLUG 2191M	MFDS 2192M	MCB 2193M
			MLUG	MFDS	MCB	MLUG	MFDS	MCB			
Incoming Neutral Bus For Bulletin 2191M (main lug) units.	Provides for incoming neutral connection to horizontal neutral bus within the main incoming unit. Incoming neutral bus must match the horizontal neutral bus, rating, half or full.	600				None			✓		
		800				None			✓		
		1200				None			✓		
		1600				None			✓		
		2000				None			✓		
		600				None			✓		
		800				None			✓		
		1200							✓		
		1600				None			✓		
		2000				None			✓		

Miscellaneous Options

Option	Description	Rating	Main Neutral Bus Location			Space Factor Adder			MLUG 2191M	MFDS 2192M	MCB 2193M
			MLUG	MFDS	MCB	MLUG	MFDS	MCB			
Incoming Neutral Bus For Bulletins 2192M (main fusible disconnect switch) and 2193M (main circuit breaker).	Provides for incoming neutral connection to horizontal neutral bus within the main incoming unit. Incoming neutral bus must match the horizontal neutral bus, rating, half or full.	400						None		✓	✓
		600					1.0	1.0		✓	✓
		800					1.0	1.0		✓	✓
		1200					1.0	1.0		✓	✓
		1600			N/A		None	N/A		✓	✓
		2000					None	None		✓	✓
		150		N/A			N/A	None			✓
		225		N/A			N/A	None			✓
		400						None		✓	✓
		600					1.0	1.0		✓	✓
		800					1.0	1.0		✓	✓
		1200					1.0	1.0		✓	✓
		1600			N/A		None	N/A		✓	✓
		2000					None	None		✓	✓
Incoming Neutral Connection Plate (can be used only in sections with a vertical wireway)	0.25″ x 2″ x 12″ copper tin plated bus plate with #6–250 kcmil lug. Insulated from and mounted on unit support pan. Located below main incoming unit if top entry and located above main incoming unit if bottom entry. Adds 0.5 space factor for main unit if less than 6.0 space factor. Not available for 2191M unit in top horizontal wireway. 280 A capacity.								✓	✓	✓
	0.25″ x 2″ x 12″ copper silver plated bus plate with #6–250 kcmil lug. Insulated from and mounted on unit support pan. Located below main incoming unit if top entry and located above main incoming unit if bottom entry. Adds 0.5 space factor for main unit if less than 6.0 space factor. Not available for 2191M unit in top horizontal wireway. 280 A capacity.								✓	✓	✓

Interposing Relay

Description	FVC	FVR	FVNR	TS1W TS2W
	2102L 2103L	2106 2107	2112 2113	2122 2123
Control circuit interposing relay. Utilizes Bulletin 700-CF control relay to control starter coil in control circuit. Available on NEMA sizes 1 through 5 and vacuum contactor starters. The starter or contactor coil voltages and interposing relay coil voltages are the same as the control voltage.	✓		✓	
		✓		✓
Line circuit interposing relay. Utilizes Bulletin 700-CF control relay to control starter coil in control circuit. Available on NEMA sizes 1 through 5. The starter or contactor coil voltages are the same as the line voltage. The interposing relay coil voltage is the same as the control voltage.	✓		✓	
		✓		✓

Unwired Control Relay

Description[1]			FVC	FVR	FVNR	TS1W TS2W
			2102L 2103L	2106 2107	2112 2113	2122 2123
			QUANTITY SUPPLIED			
Bulletin 700CF 4-pole relay		4 N.O.	1	2	1	2
		3 N.O. and 1 N.C.				
		2 N.O. and 2 N.C.				
Bulletin 700CF 4-pole relay with time attachment 0.3 to 30 seconds	On-delay includes (1) NOTC and (1) NCTO contact	4 N.O.	1	2	1	2
		2 N.O. and 2 N.C.				
	Off-delay includes (1) NOTO and (1) NCTC contact	4 N.O.				
		2 N.O. and 2 N.C.				
Bulletin 700CF 4-pole relay with time attachment 1.8 to 180 seconds	On-delay includes (1) NOTC and (1) NCTO contact	4 N.O.	1	2	1	2
		2 N.O. and 2 N.C.				
	Off-delay includes (1) NOTO and (1) NCTC contact	4 N.O.				
		2 N.O. and 2 N.C.				
Bulletin 700CF 4-pole relay with mechanical latch attachment		4 N.O.	1	2	1	2
		2 N.O. and 2 N.C.				
Bulletin 700P relay		2 N.O.	1	2	1	2
		4 N.O.				
Bulletin 700P with pneumatic time delay attachment (on/off delay) with two (2) timed contacts (0.1 to 60 seconds)		No contacts	1	2	1	2
		2 N.O.				
		4 N.O.				
Bulletin 700P with mechanical latch attachment		2 N.O.	1	2	1	2

(1) Instantaneous Contacts (Instantaneous contacts on Bulletin 700CF relays are non- convertible. Bulletin 700P relays have instantaneous contacts that are convertible from normally open to normally closed.)

Auxiliary Contacts

Description	NEMA Size	Wiring Type	Misc. Units		FVC		FVR		FVNR		TS1W TS2W		FDS		CB		Xfmr	
			2100D	2100M	2102L	2103L	2106	2107	2112	2113	2122	2123	2192F	2192M	2193F	2193M	2196	2197
One Normally Open auxiliary contact mounted on each contactor or starter	1…6	A			✓	✓			✓	✓								
							✓	✓			✓	✓						
		B			✓	✓			✓	✓								
							✓	✓			✓	✓						
One Normally Closed auxiliary contact mounted on each contactor or starter	1…6	A			✓	✓			✓	✓								
							✓	✓			✓	✓						
		B			✓	✓			✓	✓								
							✓	✓			✓	✓						

Auxiliary Contacts

Description	NEMA Size	Wiring Type	Misc. Units		FVC		FVR		FVNR		TS1W TS2W		FDS		CB		Xfmr	
			2100D	2100M	2102L	2103L	2106	2107	2112	2113	2122	2123	2192F	2192M	2193F	2193M	2196	2197
One Normally Open auxiliary contact (operates with movement of external handle only)	1…5	A or B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	6								✓	✓								
One Normally Open auxiliary contact mounted internally in circuit breaker	1…6	A or B		✓		✓		✓		✓		✓			✓	✓		✓
One Normally Closed auxiliary contact (operates with movement of external handle only)	1…5	A or B	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	6								✓	✓								
One Normally Closed auxiliary contact mounted internally in circuit breaker	1…6	A or B		✓		✓		✓		✓		✓			✓	✓		✓

Maximum Number of Additional Auxiliary Contacts Per Starter/Contactor

Bulletin Number	NEMA Size 1…2	NEMA Size 3…5	NEMA Size 6
2102L, 2103L	6	6	—
2112/2113			4
2103L/2113 Dual		—	—
2106/2107	4	4	—
2122/2123			
2102L/2103L/2112/2113 0.5SF	3	—	—

Miscellaneous Options

Option	Description	FVC	FVR	FVNR	TS1W TS2W
		2102L 2103L	2106 2107	2112 2113	2122 2123
Omission of Power Terminal Blocks	For contactors and starters (NEMA Type BD) NEMA sizes 1, 2 and 3	✓	✓	✓	✓
	For 30 A and 60 A fusible disconnect feeders	Available for Bulletin 2192F ONLY			
Control Terminal Block	One extra 5-pole control terminal block (unwired)	✓	✓	✓	✓
T-Handle	T-handle latch on unit door	Available on all units except 2191F, 2191M, 2192M, 2193M, 2195, 2193LE and 2193PP			
Key-interlock Mounting Provision	For circuit breaker or fusible disconnect main or feeder units. Permits customer mounting of Superior or Kirk brand key interlocks on unit operating handle.	Available for Bulletins 2192 and 2193 ONLY			
Current Transducers (4…20 mA Output)	Ohio Semitronics Model MCT5-005E 85…135V AC, 50/60Hz power (includes current transformer)			✓	
	Crompton Instruments Model 253-TALU-LSHG 120V AC +/-20%, 50/60Hz power (includes current transformer).			✓	
Current Sensors (4…20 mA Output)	N-K Technologies model AT 12…40V DC at sensor (current transformer not needed on sizes 1…3, included on sizes 4…6)			✓	
	Riley Corp., 5…40V DC at sensor (current transformer not needed model 420, sizes 1…3, all voltages)			✓	
	Riley Corp., 5…40V DC at sensor (current transformer not needed model 420L, size 4 (all voltages) and size 5 at 380V, 415V, 480V and 600V only)			✓	
	Riley Corp., 5…40V DC at sensor (current transformer not needed model 420X, size 5 at 208V and 240V and size 6 (all voltages))			✓	

Control Circuit Options

Option	Description		FVC	FVR	FVNR	TS1W TS2W
			2102L 2103L	2106 2107	2112 2113	2122 2123
Control Circuit Wiring	Type MTW(TEW) 90 °C copper wire, VW1 rated	#16 AWG	✓	✓	✓	✓
	Type MTW(TEW) 90 °C copper wire, VW1 rated	#14 AWG (tinned)	✓	✓	✓	✓
	Type SIS 90 °C copper wire	#14 AWG (tinned)	✓	✓	✓	✓
Control Circuit Lugs	Insulated ring lugs for control wires where possible		✓	✓	✓	✓
	Insulated spade lugs for control wires where possible		✓	✓	✓	✓

Control Circuit Options

Option	Description		FVC	FVR	FVNR	TS1W TS2W
			2102L 2103L	2106 2107	2112 2113	2122 2123
Control Wire Markers	Adhesive Brady Datab type markers at each end of control wire.		✓	✓	✓	✓
	Heat shrink type wire marker.		✓	✓	✓	✓
	Sleeve type wire marker.		✓	✓	✓	✓
Omission of Circuit Breaker	For combination starter units, HMCP frame only. N/A in 0.5 space factor units.	NEMA size 1 and 2		✓	✓	✓
		NEMA size 3		✓	✓	✓
		NEMA size 4		✓	✓	✓
Shunt Trip	For tripping circuit breakers from remote 120 volt, 60 Hz source.		Available on all circuit breaker units			
100% Rating of Main Disconnect Switch or Circuit Breaker	Provides 100% rating of main switch or circuit breaker. NEMA Type 1 and Type 1 with gasket only, except non-fused 2192M is available in NEMA Type 12. Not available with NEMA Type 3R or Type 4.		Available on 2192M, 600…2000 A			
			Available on 2193M, 600…2000 A Only			

Miscellaneous Options

Option	Description		FVC	FVR	FVNR	TS1W TS2W
			2102L 2103L	2106 2107	2112 2113	2122 2123
External DeviceNet Connector with 120V AC Receptacle	Door mounted external DeviceNet connection and 120V AC receptacle for connection of computer to DeviceNet without having to open doors. Mounted on door of DeviceNet power supply unit.		Available on 2100-DPS_ units only			
DeviceNet Power Supply, Redundant Design	Provides second power supply and anti-backfeed, blocking diodes. Allows seemless transfer of power from primary to secondary power supply in the event of an internal failure of the primary power supply.		Available only for 2100-DPS8_ units			
Unwired Pull-Apart Terminal Blocks	Bulletin 1492-EC 5-pole terminal blocks	All mounting tabs on unit bottom plate are turned up for field installed terminal blocks	Available on 2100-NK and 2100-NJ empty unit inserts and 2100D and 2100M empty unit inserts with disconnecting means ONLY Not available on 2100-NK05 or 2100-NJ05 units			
		All mounting tabs on unit bottom plate are turned up. (1) Five-pole pull-apart terminal block included.				
		All mounting tabs on unit bottom plate are turned up. (2) Five-pole pull-apart terminal blocks included.				
		All mounting tabs on unit bottom plate are turned up. (3) Five-pole pull-apart terminal blocks included.				
		All mounting tabs on unit bottom plate are turned up. (4) Five-pole pull-apart terminal blocks included.				
French Legend Plates	Legend plates printed in French are available on all pilot devices.		Available on all pilot devices			
Spanish Legend Plates	Legend plates printed in Spanish are available on all pilot devices.		Available on all pilot devices			
Unit Door Nameplates	Door Nameplate Screws	Plated steel nameplate screws. Provided when cardholder or nameplates are not selected.	Available on all units			
	Card Holder for Unit Doors	1.125" x 3.625" plastic card holders with blank cards.	Available on all units			
	1.125″ x 3.625″ engraved 3-line or 4-line nameplate	Acrylic plate. Lettering is white with black letters or black with white letters.	Available on all units			
		Phenolic plate. Lettering is white with black letters, black with white letters or red with white letters.	Available on all units			

Miscellaneous Options

Option	Description	FVC	FVR	FVNR	TS1W TS2W
		2102L 2103L	2106 2107	2112 2113	2122 2123
Overload Relay Heater Elements (Bulletin 592)	Set of three W-type heater elements per overload supplied loose in each unit.	✓	✓	✓	✓
Stainless Steel Nameplate Screws	Stainless steel nameplate screws for unit nameplates (2 per unit)	Available on all units			
Export Packing Below Deck	Container is skid mounted and packaged in clear plastic. Packing is not watertight or waterproof. Considerations should be taken if extended storage is expected.	✓	✓	✓	✓

Soft Starter Units

These combination soft starter units contain a microprocessor-controlled motor controller, control circuit transformer and either a fusible disconnect switch or circuit breaker.

SMC-3 Soft Starter Units - Bulletin 2154H and 2155H Features

- Three starting modes: soft start, kick start and current limit
- Electronic overload protection with selectable overload trip class
- Motor and system diagnostics
- Configurable auxiliary contacts
- Soft stop
- Integrated bypass contactor

SMC Flex Soft Starter Units - Bulletin 2154J and 2155J Features

- Seven standard modes of operation: soft start, current limit start, dual ramp, full voltage, linear speed acceleration, preset slow speed and soft stop
- Optional modes of operation: pump control, Smart Motor Braking ™, Accu-Stop™ and slow speed with braking
- Integral SCR bypass
- Electronic overload protection with selectable trip class
- Full metering and diagnostics
- Four programmable auxiliary contacts
- DPI communication
- LCD display
- Keyboard programming

Specify a soft starter rather than a variable frequency drive when the following is required:

- A cost effective starter
- No speed control
- Simple acceleration and deceleration
- Lower starting torque
- Generously sized motor for the load
- Standard starting and stopping manoeuvres
- Dynamic braking is not required
- The starter is not used to hold the rotor in place at zero speed

For additional information regarding soft starters, refer to the SMC Flex and SMC-3 Selection Guide, publication 150-SG009.

For SMC-3 soft starter unit selection, go to page 65
For SMC Flex soft starter unit selection, go to page 66
For soft starter unit options, go to page 67

Bulletin 2154H Combination Soft Starter Motor Controller with Fusible Disconnect Switch (SMC-3)

Rating (Amperes)	Nominal Horsepower (Nominal kW) [1]					Disconnect Rating	NEMA Type 1 and Type 1 with gasket	NEMA Type 12
	220…230V	240V	380…415V	480V	600V		Space Factor[2]	Space Factor[2]
3	(0.25-0.55)	0.5	(0.37…1.1)	0.5…1.5	0.75…2	30	0.5	0.5
9	(0.75-2.2)	0.75…2	(1.5…3.7)	2…5	3…7.5	30	0.5	0.5
19	(3.7)	3…5	(5.5…7.5)	7.5…10	10…15	30	0.5	0.5
25	(5.5)	7.5	(11)	15	20	30	1.0	1.0
30	(7.5)	10	(15)	20	25	60	1.0	1.0
37	—	—	(18.5)	25	30	60	1.0	1.0
43	(11)	15	(22)	30	40	60	1.5	2.0
60	(15)	20	(30)	40	50	100	1.5	2.5
85	(18.5…22)	25…30	(37)	50	—	100		
	—	—	(45)	60	60…75	200		
108	(30)	40	(55)	75	100	200	3.5	4.0
135	(37)	50	—	100	125	200		

(1) The horsepower and kW ratings shown are nominal. The limiting factor in the application and use of the SMC-3 is the output ampere rating.
(2) Adding options may increase the space factor of the unit.

Bulletin 2155H Combination Soft Starter Motor Controller with Circuit Breaker (SMC-3)

Rating (Amperes)	Nominal Horsepower (Nominal kW)[1]					NEMA Type 1 and Type 1 with gasket	NEMA Type 12
	220…230V	240V	380…415V	480V	600V	Space Factor[2]	Space Factor[2]
3	(0.25…0.55)	0.5	(0.37…1.1)	0.5…1.5	0.75…2	1.0	1.0
9	(0.75…2.2)	0.75…2	(1.5…3.7)	2…5	3…7.5		
19	(3.7)	3…5	(5.5…7.5)	7.5…10	10…15		
25	(5.5)	7.5	(11)	15	20		
30	(7.5)	10	(15)	20	25		
37	—	—	(18.5)	25	30		
43	(11)	15	(22)	30	40	1.5	2.0
60	(15)	20	(30)	40	50		2.5
85	(18.5…22)	25…30	(37)	50	—		3.0
	—	—	(45)	60	60…75		
108	(30)	40	(55)	75	100	2.5	3.5
135	(37)	50	—	100	—	2.5	
135	—	—	—		125	3.0	

(1) The horsepower and kW ratings shown are nominal. The limiting factor in the application and use of the SMC-3 is the output ampere rating.
(2) Adding options may increase the space factor of the unit.

Bulletin 2154J - SMC Flex Soft Starter Motor Controller with Fusible Disconnect Switch - Line Connected

Rating (Amperes)	Nominal Horsepower (Nominal kW)[1]					Disconnect Rating	NEMA Type 1 and Type 1 w/ gasket	NEMA Type 12
	220…230V	240V	380…415V	480V	600V		Space Factor[2]	Space Factor[2]
5	(0.25…1.1)	0.5…1	(0.37…2.2	0.5…3	0.75…3	30	2.0	3.0
25	(1.5…5.5)	1.5…7.5	(3.7…11)	5…15	5…20	30		
43	(7.5…11)	10…15	(15…22)	20…30	25…40	60		
60	(15)	20	(30)	40	50	100	2.5	
85	(18.5…22)	25…30	(37)	50	—	100		
	—	—	(45)	60	60…75	200		3.5
108	(30)	40	(55)	75	100	200	3.5	4.0
135	(37)	50	—	100	125	200		
201	(45…55)	60…75	(75…90)	125…150	150…200	400	6.0, 20″ W	6.0 20″ W
251	(75)	100	(110…132)	200	250	400		
317	(90)	125	(150…160)	250	300	400	6.0, 20″ W, 20″ D	6.0, 20″ W, 20″ D
361	(110)	150	(185)	300	350	600		
480	(132)	200	(200…250)	350…400	400…500	600		

(1) The horsepower and kW ratings shown are nominal. The limiting factor in the application and use of the SMC Flex is the output ampere rating.
(2) Adding options may increase the space factor of the unit.

Bulletin 2155J - SMC Flex Soft Starter Motor Controller with Circuit Breaker - Line Connected

Rating (Amperes)	Nominal Horsepower (Nominal kW)[1]					NEMA Type 1 and Type 1 w/ gasket	NEMA Type 12
	220…230V	240V	380…415V	480V	600V	Space Factor[2]	Space Factor[2]
5	(0.25…1.1)	0.5…1	(0.37…2.2)	0.5…3	0.75…3	2.0	3.0
25	(1.5…5.5)	1.5…7.5	(3.7…11)	5…15	5…20		
43	(7.5…11)	10…15	(15…22)	20…30	25…40		
60	(15)	20	(30)	40	50		
85	(18.5…22)	25-30	(37)	50…60	60…75		
	—	—	(45)	—	—	2.5	3.0
108	(30)	40	(55)	75	100		3.5
135	(37)	50	—	100	125		
201	(45…55)	60…75	(75…90)	125…150	150…200	6.0, 20″ W	6.0, 20″ W
251	(75)	100	(110…132)	200	250		
317	(90)	125	(150…160)	250	300	6.0 20″ W, 20″ D	6.0 20″ W, 20″ D
361	(110)	150	(185)	300	350		
480	(132)	200	(200…250)	350…400	400…500		

(1) The horsepower and kW ratings shown are nominal. The limiting factor in the application and use of the SMC Flex is the output ampere rating.
(2) Adding options may increase the space factor of the unit.

Soft Starter Unit Options

These tables provide information on the options available for Soft Starter units.

Optional Equipment for Soft Starter Units

Option	Description	SMC-3		SMC Flex	
		2154H	2155H	2154J	2155J
Push Buttons	Start-Stop	✓	✓	✓	✓
	Stop	✓	✓	✓	✓
	Start-Stop and Soft Stop			✓	✓
	Start-Stop and Pump Stop			✓	✓
	Start-Stop and Slow Speed			✓	✓
	Start-Stop and Brake			✓	✓
	Start-Stop and ACCU-Stop			✓	✓
	Start-Stop, Slow Speed and Brake			✓	✓
Control Station Housing	Blank	✓	✓	✓	✓
	1 hole—for one pilot device	✓	✓	✓	✓
	2 holes—for two pilot devices	✓	✓	✓	✓
	3 holes—for three pilot devices	✓	✓	✓	✓
	4 holes—for four pilot devices	✓			
Selector Switch	Hand-Off-Auto	✓	✓	✓	✓
	Off-On	✓	✓	✓	✓
Selector Switch	Hand-Off-Auto for Soft Stop			✓	✓
	Hand-Off-Auto for Pump Control			✓	✓
	Hand-Off-Auto for Smart Motor Braking			✓	✓

Pilot Lights (Transformer Type for 800T, Full-voltage for 800F) for Soft Starter Units

Description		SMC-3		SMC Flex	
		2154H	2155H	2154J	2155J
Standard type	On	✓	✓	✓	✓
	On-Off	✓	✓	✓	✓
	Fault	✓	✓	✓	✓
LED type	On	✓	✓	✓	✓
	On-Off	✓	✓	✓	✓
	Fault	✓	✓	✓	✓
Push-To-Test Standard Type	On	✓	✓	✓	✓
	On-Off	✓	✓	✓	✓
	Fault	✓	✓	✓	✓
Push-To-Test LED Type	On	✓	✓	✓	✓
	On-Off	✓	✓	✓	✓
	Fault	✓	✓	✓	✓

Protective module contains capacitors and metal oxide varistors (MOVs) which protect the internal power circuitry from severe electrical transients and high electrical noise

Protective Modules for Soft Starter Units

Description			SMC-3		SMC Flex	
			2154H	2155H	2154J	2155J
Line Side	480V max.	3…37 A	✓	✓		
		43…85 A	✓	✓		
		108…135 A	✓	✓		
		5…85 A			✓	✓
		108…480 A			✓	✓
	600V	3…37 A	✓	✓		
		43…85 A	✓	✓		
		108…135 A	✓	✓		
		5…85 A			✓	✓
		108…480 A			✓	✓
Load Side	480V max.	43…85 A	✓	✓		
		108…135 A	✓	✓		
		5…85 A			✓	✓
		108…480 A			✓	✓
	600V	43…85 A	✓	✓		
		108…135 A	✓	✓		
		5…85 A			✓	✓
		108…480 A			✓	✓

Soft Starter Options

Option	Description		SMC-3		SMC Flex	
			2154H	2155H	2154J	2155J
DeviceNet Starter Auxiliary (mutually exclusive)	Four 120V AC inputs and two 120V AC outputs for DeviceNet.		✓	✓	✓	✓
	Four 24V DC inputs and two 120V AC outputs for DeviceNet.		✓	✓	✓	✓
Communication Modules (mutually exclusive)	ControlNet communication module. Mounted internal to SMC Flex. Includes one 1786-TPYS tap, supplied loose for customer mounting.				✓	✓
	DeviceNet communication module. Mounted internal to SMC Flex.				✓	✓
	Ethernet communication module. Mounted internal to SMC Flex.				✓	✓
	Single Point Remote I/O				✓	✓
Ground Fault Current Transformer	Provides ground fault core balance current transformer for ground fault indication				✓	✓
Human Interface Module (HIM) (mutually exclusive)	Blank Cover. No functionality	Door mounted in bezel. Cable to SMC Flex unit included. No window on door. Available on NEMA Type 1 and Type 1 with gasket only.			✓	✓
	LCD display, full numeric keypad				✓	✓
	LCD display programmer only				✓	✓
	LCD display, full numeric keypad	Door mounted. HIM is not removable from bezel. One HIM required per SMC Flex unit. No window on door. Available on NEMA 12 only.			✓	✓
	LCD display programmer only				✓	✓

Soft Starter Options

Option	Description			SMC-3		SMC Flex	
				2154H	2155H	2154J	2155J
High Interrupting Capacity Fuses (Class J - Time Delay)	Provides unit with high interrupting capacity fuses for increased short circuit withstand rating.	Class J - Time Delay	3…19 A		✓		
			25…37 A		✓		
			43…60 A		✓		
			85…108 A		✓		
			135 A		✓		
			5 A				✓
			25 A				✓
			43…60 A				✓
			85…108 A				✓
			135…201 A				✓
			251…361 A				✓
		Class L - Time Delay	480 A				✓

Soft Starter Options

Option	Description		SMC-3		SMC Flex	
			2154H	2155H	2154J	2155J
Add Isolation Contactor	Provides unit with Bulletin 100 isolation contactor.	3…19 A	✓	✓	✓	✓
		24 A, 25 A	✓	✓	✓	✓
		30…37 A	✓	✓		
		43 A	✓	✓	✓	✓
		54…60 A	✓	✓	✓	✓
		85 A	✓	✓	✓	✓
		97…108 A	✓	✓	✓	✓
		135…180 A	✓	✓	✓	✓
		201…251 A			✓	✓
		317…361 A			✓	✓
		480…500 A			✓	✓
Standard Starting Mode	This starting mode group provides soft start, soft stop, current limit, full voltage, kick start, preset slow speed, linear speed start and stop and dual ramp.	5…480 A			✓	✓
Pump Control	This starting mode provides pump start and stop in addition to soft start, soft stop, current limit, full voltage and kick start.	5…480 A			✓	✓

Soft Starter Options

Option	Description		SMC-3		SMC Flex	
			2154H	2155H	2154J	2155J
Braking Control Smart Motor Braking, Accu-Stop and Slow Speed Braking	This starting mode provides Smart Motor Braking, Accu-Stop and Slow Speed Braking in addition to soft start, soft stop, current limit, full voltage, kick start and preset slow speed.	5…85 A			✓	✓
		108 A			✓	✓
		135 A			✓	✓
		201 A			✓	✓
		251 A			✓	✓
		317 A			✓	✓
		361 A			✓	✓
		480 A			✓	✓

Soft Starter Options

Option	Description		SMC-3		SMC Flex	
			2154H	2155H	2154J	2155J
Surge Suppressor	Provides surge suppressor across coil of unwired control relays		✓	✓	✓	✓
Omit Wiring	Omission of control wiring		✓	✓	✓	✓
Grounded Unit Door	Hinge mounted ground strap mounted on bottom hinge of unit door. Unit door hinge grounding strap for IEC requirements.		✓	✓	✓	✓
Unit Load Connector	Specify on all plug-in units in sections with vertical unit load ground bus	Unplated copper	✓	✓	✓	✓
		Tin plated copper	✓	✓	✓	✓
Unit Ground Stab	Specify on plug-in units in sections with vertical plug-in ground bus. Copper unit ground stabs also may be used with steel vertical ground bus.	Copper alloy	✓	✓	✓	✓
		Unplated copper	✓	✓	✓	✓
		Tin plated copper	✓	✓	✓	✓

Soft Starter Options

Option	Description			SMC-3		SMC Flex	
				2154H	2155H	2154J	2155J
Unwired Control Relay(1)	Bulletin 700CF 4-Pole Relay		4 N.O.	✓	✓	✓	✓
			3 N.O. and 1 N.C.	✓	✓	✓	✓
			2 N.O. and 2 N.C.	✓	✓	✓	✓
	Bulletin 700CF 4-Pole Relay with Time Attachment 0.3…30 seconds	On Delay Includes one NOTC and one NCTO Contact	4 N.O.	✓	✓	✓	✓
			2 N.O. and 2 N.C.	✓	✓	✓	✓
		Off Delay Includes one NOTO and one NCTC Contact	4 N.O.	✓	✓	✓	✓
			2 N.O. and 2 N.C.	✓	✓	✓	✓
	Bulletin 700CF 4-Pole Relay with Time Attachment 1.8…180 seconds	On Delay Includes one NOTC and one NCTO Contact	4 N.O.	✓	✓	✓	✓
			2 N.O. and 2 N.C.	✓	✓	✓	✓
		Off Delay Includes one NOTO and one NCTC Contact	4 N.O.	✓	✓	✓	✓
			2 N.O. and 2 N.C.	✓	✓	✓	✓
	Bulletin 700CF 4-Pole Relay with Mechanical Latch Attachment		4 N.O.	✓	✓	✓	✓
			2 N.O. and 2 N.C.	✓	✓	✓	✓
	Bulletin 700P Relay		2 N.O.			✓	✓
			4 N.O.			✓	✓
	Bulletin 700P with Pneumatic Time Delay Attachment (on/off delay) with two timed contacts (0.1…60 sec)		None			✓	✓
			2 N.O.			✓	✓
			4 N.O.			✓	✓
	Bulletin 700P Relay with Mechanical Latch Attachment		2 N.O.			✓	✓

(1) Instantaneous Contacts (Instantaneous contacts on Bulletin 700CF relays are non-convertible Bulletin 700P relays have instantaneous contacts that are convertible from normally open to normally closed.)

Soft Starter Options

Option	Description	SMC-3		SMC Flex	
		2154H	2155H	2154J	2155J
T-Handle	T-Handle latch on unit door	✓	✓	✓	✓
Control Circuit Wiring	Type MTW (TEW) 90 °C #16 AWG copper wire, VW1 rated	✓	✓	✓	✓
	Type MTW (TEW) 90 °C #14 AWG (tinned) copper wire, VW1 rated	✓	✓	✓	✓
	#14 AWG tinned, MTW, 90 °C copper wire, VW1 rated and tinned power wire, including stab wires.	✓	✓	✓	✓
	Type SIS 90 °C #14 AWG (tinned) copper wire	✓	✓	✓	✓
Control Circuit Ring Lugs	Insulated ring lugs for control wires where possible	✓	✓	✓	✓
Control Circuit Spade Lugs	Insulated spade lugs for control wires where possible	✓	✓	✓	✓
Control Wire Markers	Adhesive Brady Datab type markers at each end of control wire. Not available in Canada.	✓	✓	✓	✓
	Heat shrink type marker at each end of control wire	✓	✓	✓	✓
	Sleeve type marker at each end of control wire	✓	✓	✓	✓
Shunt Trip	For tripping circuit breakers from remote 120V, 60 Hz source		✓		✓
French Legend Plates	Legend plates printed in French are available on all pilot devices.	✓	✓	✓	✓

Soft Starter Options

Option	Description		SMC-3		SMC Flex	
			2154H	2155H	2154J	2155J
Spanish Legend Plates	Legend plates printed in Spanish are available on all pilot devices.		✓	✓	✓	✓
Unit Door Nameplates	Door Nameplate Screws	Plated steel nameplate screws. Provided when cardholder or nameplates are not selected.	✓	✓	✓	✓
	Card Holder for Unit Doors	1.125" x 3.625" plastic card holders with blank cards	✓	✓	✓	✓
	1.125″ x 3.625″ engraved 3-line or 4-line nameplate	Acrylic plate. Lettering is white with black letters or black with white letters.	✓	✓	✓	✓
		Phenolic plate. Lettering is white with black letters, black with white letters, or red with white letters.	✓	✓	✓	✓
Stainless Steel Nameplate Screws	Stainless steel nameplate screws for unit nameplates (2 per unit)		✓	✓	✓	✓
Export Packing Below Deck	Container is skid mounted and packaged in clear plastic. Packing is not watertight or waterproof. Considerations should be taken if extended storage is expected.		✓	✓	✓	✓

Auxiliary Contacts Type B Wiring

Description	SMC-3		SMC Flex	
	2154H	2155H	2154J	2155J
One Normally Open auxiliary contact mounted on isolation contactor when supplied	✓	✓	✓	✓
One Normally Closed auxiliary contact mounted on isolation contactor when supplied	✓	✓	✓	✓
One Normally Open mounted on operating mechanism (operates with movement of external handle only)	✓	✓	✓	✓
One Normally Open mounted internally. Circuit breaker units only.		✓		✓
One Normally Closed mounted on operating mechanism (operates with movement of external handle only)	✓	✓	✓	✓
One Normally Closed mounted internally. Circuit breaker units only.		✓		✓

Notes:

Variable Frequency Drive Units

The combination variable frequency AC motor drive units contain a high performance, microprocessor-controlled, variable frequency AC drive and either a fusible disconnect switch or a circuit breaker.

They also:

- Include isolated logic and power.
- Include fans and venting where required.
- Include internal electronic overload protection.
- Include EMC filters on 380…415V AC.
- Include UL Class CC (PowerFlex 40 drives) or J time delay fuses. These fuses provide both branch circuit protection and drive input protection. The drive input fuses are provided in series with the circuit breaker in some drive units.
- Include control circuit transformer (CCT). The CCT is sized to provide power for all standard pilot devices and any required fans.
- Produce a three-phase, pulse width modulated (PWM) adjustable frequency output and voltage output for exceptional control of motor speed and torque.
- Are digitally programmable with access to mode programming, providing precise and repeatedly accurate setup, control and operation and adaptability to handle a variety of applications.
- Have available 24V DC or 115V AC control voltages on some units.

You will need to select a Human Interface Module (HIM) and Control Platform Type for the drive units.

Select the drive unit based on nominal load HP(kW) size. If full load current exceeds ouitpout current, select the unit based on the next larger HP(kW).

Drives listed as Normal Duty have output current overload capabilities are 110% for 60 seconds and 150% for 3 seconds. Drives listed as Heavy Duty have output current overload capabilities are 150% for 60 seconds and 200% for 3 seconds.

Each unit is provided as a NEMA Wiring Class I, Type A unit with terminals mounted on the drive chassis for connection of remote pilot devices and input signals. For NEMA Type 3R and NEMA Type 4 enclosure construction, contact your local Rockwell Automation Sales Office or Allen-Bradley distributor.

Proper placement of drive units in the MCC is essential for proper operation and life cycle of the drive. Strong consideration should be given to placing units with drives at the bottom of the section. When more than one drive unit is placed in a section, the drive unit with the highest rating should be located at the bottom of the section.

Do not mount transormer units below drive units. Heat from the transformer units may cause the drive to trip.

For additional information regarding variable frequency drives refer to the PowerFlex Low Voltage Drives Selection Guide, publication PFLEX-SG002.

For PowerFlex 40 drive unit selection go to page 75.
For PowerFlex 70 drive unit selection go to page 76.
For PowerFlex 700 drive unit selection go to page 79.
For PowerFlex 753 drive unit selection go to page 83.
For variable frequency drive unit options go to page 88.

Bulletin 2162T - Combination PowerFlex 40 Variable Frequency AC Drive (VFD) Units with Fusible Disconnects

Nominal Load HP(kW)	380V, 400V, and 415V			480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12
0.5 (0.37)	1.4	1.0	1.5	1.4	1.0	1.5			
0.75 - 1.0 (0.55 - 0.75)	2.3			2.3			1.7	1.0	1.5
2.0 (1.1 - 1.5)	4.0			4.0			3.0		
3.0 (2.2)	6.0			6.0			4.2		
5.0 (3.7)	10.5		2.0	10.5		2.0	6.6		2.0
7.5 (5.5)	12	2.0	2.5	12	2.0	2.5	9.9	2.0	2.5
10 (7.5)	17			17			12.2		
15 (11)	24		3.0	24		3.0	19.0		3.0

(1) Adding options may increase the space factor of the unit.

Bulletin 2163T - Combination PowerFlex 40 Variable Frequency AC Drive (VFD) Units with Circuit Breaker

Nominal Load HP(kW)	380V, 400V, and 415V			480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12
0.5 (0.37)	1.4	1.0	1.5	1.4	1.0	1.5			
0.75…1.0 (0.55…0.75)	2.3			2.3			1.7	1.0	1.5
1.5…2.0 (1.1…1.5)	4.0			4.0			3.0		
3.0 (2.2)	6.0			6.0			4.2		
5.0 (3.7)	10.5		2.0	10.5		2.0	6.6		2.0
7.5 (5.5)	12	2.0	2.5	12	2.0	2.5	9.9	2.0	2.5
10 (7.5)	17			17			12.2		
15 (11)	24		3.0	24		3.0	19.0		3.0

(1) Adding options may increase the space factor of the unit.

Bulletin 2162Q - Combination PowerFlex 70 Variable Frequency AC Drive (VFD) Units with Fusible Disconnect (Normal Duty)

Nominal Load HP(kW)	380V, 400V, and 415V			480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12
0.5 (0.37)	1.3	1.5	2.0	1.1	1.5	2.0	0.9	1.5	2.0
0.75 (0.55)	1.5			1.6			1.3		
1.0 (0.75)	2.1			2.1			1.7		
1.5 (1.1)	2.6			3			2.4		
2 (1.5)	3.5			3.4			2.7		
3 (2.2)	5			5			3.9		
5 (3.7)	8.7		2.5	8		2.5	6.1		2.5
7.5 (5.5)	11.5	2.0	3.0	11	2.0	3.0	9	2.0	3.0
10 (7.5)	15.4			14			11		
15 (11)	22	2.5		22	2.5		17	2.5	
20 (15)	30		3.5	27		3.5	22		3.5
25 (18.5)	37		3.0	34		3.0	27		3.0
30 (22)	43	3.0	3.5	40	3.0	3.5	32	3.0	3.5
40 (30)	60		4.0	52		4.0	41		4.0
50 (37)	72	3.5		65	3.5		52	3.5	

(1) Adding options may increase the space factor of the unit.

Bulletin 2162Q - Combination PowerFlex 70 Variable Frequency AC Drive (VFD) Units with Fusible Disconnect (Heavy Duty)

Nominal Load HP(kW)	480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/Gasket	NEMA Type 12		NEMA Type 1 and 1 w/Gasket	NEMA Type 12
0.5 (0.37)	1.1	1.5	2.0	0.9	1.5	2.0
0.75 (0.55)	1.6			1.3		
1.0 (0.75)	2.1			1.7		
1.5 (1.1)	3.0			2.4		
2 (1.5)	3.4			2.7		
3 (2.2)	5.0		2.5	3.9		2.5
5 (3.7)	8.0	2.0	3.0	6.1	2.0	3.0
7.5 (5.5)	11			9.0		
10 (7.5)	14	2.5		11	2.5	
15 (11)	22		3.5	17		3.5
20 (15)	27		3.0	22		3.0
25 (18.5)	34	3.0	3.5	27		
30 (22)	40	3.0	4.0	32	3.0	4.0
40 (30)	52	3.5	4.0	41		

(1) Adding options may increase the space factor of the unit.

Bulletin 2163Q - Combination PowerFlex 70 Variable Frequency AC Drive (VFD) Units with Circuit Breaker Disconnect (Normal Duty)

Nominal Load HP(kW)	380V, 400V, and 415V			480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12
0.5 (0.37)	1.3	1.5	2.0	1.1	1.5	2.0	0.9	1.5	2.0
0.75 (0.55)	1.5			1.6			1.3		
1.0 (0.75)	2.1			2.1			1.7		
1.5 (1.1)	2.6			3.0			2.4		
2 (1.5)	3.5			3.4			2.7		
3 (2.2)	5.0			5.0			3.9		
5 (3.7)	8.7		2.5	8.0		2.5	6.1		2.5
7.5 (5.5)	11.5	2.0	3.0	11	2.0	3.0	9.0	2.0	3.0
10 (7.5)	15.4			14			11		
15 (11)	22	2.5		22	2.5		17	2.5	
20 (15)	30		3.5	27		3.5	22		3.5
25 (18.5)	37		3.0	34		3.0	27		3.0
30 (22)	43	3.0	3.5	40	3.0	3.5	32		
40 (30)	60	3.0	4.0	52	3.0	4.0	41	3.0	4.0
50 (37)	72	4.0	4.0	65	3.5	4.0	52		

(1) Adding options may increase the space factor of the unit.

Bulletin 2163Q - Combination PowerFlex 70 Variable Frequency AC Drive (VFD) Units with Circuit Breaker Disconnect (Heavy Duty)

Nominal Load HP(kW)	480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/Gasket	NEMA Type 12		NEMA Type 1 and 1 w/Gasket	NEMA Type 12
0.5 (0.37)	1.1	1.5	2.0	0.9	1.5	2.0
0.75 (0.55)	1.6			1.3		
1.0 (0.75)	2.1			1.7		
1.5 (1.1)	3.0			2.4		
2 (1.5)	3.4			2.7		
3 (2.2)	5		2.5	3.9		
5 (3.7)	8	2.0	3.0	6.1		2.5
7.5 (5.5)	11			9.0	2.0	3.0
10 (7.5)	14	2.5		11		
15 (11)	22		3.5	17	2.5	
20 (15)	27		3.0	22		3.5
25 (18.5)	34	3.0	3.5	27		3.0
30 (22)	40	3.0	4.0	32		
40 (30)	52	3.5	4.0	41	3.0	4.0

(1) Adding options may increase the space factor of the unit.

Bulletin 2162R - Combination PowerFlex 700 Variable Frequency AC Drive (VFD) Units with Fusible Disconnect (Normal Duty)

Nominal Load HP(kW)	380V, 400V, and 415V			480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12
0.5 (0.37)	1.3	2.0	2.0	1.1	2.0	2.0			
0.75 (0.55)	1.5			1.6					
1 (0.75)	2.1			2.1			1.7	2.0	2.0
1.5 (1.1)	2.6			3.0			2.4		
2 (1.5)	3.5			3.4			2.7		
3 (2.2)	5.0			5.0			3.9		
5 (3.7)	8.7		2.5	8.0		2.5	6.1		2.5
7.5 (5.5)	11.5			11			9.0		
10 (7.5)	15.4			14			11		
15 (11)	22		3.0	22		3.0	17		3.0
20 (15)	30	2.5		27	2.5		22	2.5	
25 (18.5)	37			34			27		
30 (22)	43	3.0	3.5	40	3.0	3.5	32	3.0	3.5
40 (30)	56		4.0	52		4.0	41		4.0
50 (37)	72			65			52		
60 (45)	85	6.0, 25″W, 20″D	6.0, 25″W, 20″D	77	6.0, 20″ W	6.0, 25″ W	62	6.0, 20″W	6.0, 25″W
75 (55)	105			96	6.0 25″W, 20″D	6.0 25″W, 20″D	77	6.0, 25″W, 20″D	6.0, 25″W, 20″D
100 (75)	138		6.0, 30″W, 20″D	125			99		6.0, 30″W, 20″D
125 (90)	170			156		6.0 30″W, 20″D	125		
150 (110)	205	6.0, 35″W, 20″D	Available in NEMA Type 1 and Type 1 with gasket only	180		6.0 35″W, 20″D	144		6.0, 35″W, 20″D
		6.0, 30″W, 20″D							
200 (132)	255	6.0, 35″W, 20″D		255	6.0, 35″W, 20″D	Available in NEMA Type 1 and Type 1 with gasket only			
		6.0, 30″W, 20″D			6.0, 30″W, 20″D				

(1) Adding options may increase the space factor of the unit.

Bulletin 2162R - Combination PowerFlex 700 Variable Frequency AC Drive (VFD) Units with Fusible Disconnect (Heavy Duty)

Nominal Load HP(kW)	480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/Gasket	NEMA Type 12		NEMA Type 1 and 1 w/Gasket	NEMA Type 12
0.5	1.1	2.0	2.0			
0.75	1.6					
1	2.1			1.7	2.0	2.0
1.5	3.0			2.4		
2	3.4			2.7		
3	5.0		2.5	3.9		2.5
5	8.0			6.1		
7.5	11			9.0		
10	14		3.0	11		3.0
15	22	2.5		17	2.5	
20	27			22		
25	34	3.0	3.5	27	3.0	3.5
30	40		4.0	32		4.0
40	52			41		
50	65	6.0, 20″W	6.0, 25″ W	52	6.0, 20″W	6.0, 25″W
60	77	6.0 25″W, 20″D	6.0 25″W, 20″D	62	6.0, 25″W, 20″D	6.0 25″W, 20″D
75	96			77		6.0, 30″W, 20″D
100	125		6.0 30″W, 20″D	99		
125	156		6.0 35″W, 20″D	125		6.0, 35″W, 20″D
150	180	6.0 35″W, 20″D	Available in NEMA Type 1 and Type 1 with gasket only			
		6.0 30″W, 20″D				
200	245	6.0, 35″W, 20″D				
		6.0, 30″W, 20″D				

(1) Adding options may increase the space factor of the unit.

Bulletin 2163R - Combination PowerFlex 700 Variable Frequency AC Drive (VFD) Units with Circuit Breaker (Normal Duty)

Nominal Load HP(kW)	380V, 400V, and 415V			480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12		NEMA Type 1 and 1 w/ Gasket	NEMA Type 12
0.5 (0.37)	1.3	2.0	2.0	1.1	2.0	2.0			
0.75 (0.55)	1.5			1.6					
1 (0.75)	2.1			2.1			1.7	2.0	2.0
1.5 (1.1)	2.6			3.0			2.4		
2 (1.5)	3.5			3.4			2.7		
3 (2.2)	5.0			5.0			3.9		
5 (3.7)	8.7		2.5	8.0		2.5	6.1		2.5
7.5 (5.5)	11.5			11			9.0		
10 (7.5)	15.4			14			11		
15 (11)	22		3.0	22		3.0	17		3.0
20 (15)	30	2.5		27	2.5		22	2.5	
25 (18.5)	37			34			27		
30 (22)	43	3.0	3.5	40	3.0	3.5	32	3.0	3.5
40 (30)	56		4.0	52		4.0	41		4.0
50 (37)	72	3.5		65	3.5		52	3.5	
60 (45)	85	6.0, 25″W, 20″D	6.0, 25″W, 20″D	77	6.0, 20″ W	6.0, 25″ W	62	6.0, 20″W	6.0, 25″W
75 (55)	105			96	6.0 25″W, 20″D	6.0, 25″W, 20″D	77	6.0, 25″W, 20″D	6.0, 25″W, 20″D
100 (75)	138		6.0, 30″W, 20″D	125			99		6.0, 30″W, 20″D
125 (90)	170			156		6.0 30″W, 20″D	125		
150 (110)	205	6.0, 30″W, 20″D	Available in NEMA Type 1 and Type 1 with gasket only.	180		6.0 35″W, 20″D	144		6.0, 35″W, 20″D
200 (132)	255			255	6.0, 30″W, 20″D	Available in NEMA Type 1 and Type 1 with gasket only			

(1) Adding options may increase the space factor of the unit.

Bulletin 2163R - Combination PowerFlex 700 Variable Frequency AC Drive (VFD) Units with Circuit Breaker (Heavy Duty)

Nominal Load HP(kW)	480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/Gasket	NEMA Type 12		NEMA Type 1 and 1 w/Gasket	NEMA Type 12
0.5	1.1	2.0	2.0			
0.75	1.6					
1	2.1			1.7	2.0	2.0
1.5	3.0			2.4		
2	3.4			2.7		
3	5.0		2.5	3.9		2.5
5	8.0			6.1		
7.5	11			9.0		
10	14		3.0	11		3.0
15	22	2.5		17	2.5	
20	27			22		
25	34	3.0	3.5	27	3.0	3.5
30	40		4.0	32		4.0
40	52	3.5		41	3.5	
50	65	6.0, 20″ W	6.0, 25″ W	52	6.0, 20″W	6.0, 25″W
60	77	6.0 25″W, 20″D	6.0 25″W, 20″D	62	6.0, 25″W, 20″D	6.0, 25″W, 20″D
75	96			77		6.0, 30″W, 20″D
100	125		6.0 30″W, 20″D	99		
125	156		6.0 35″W, 20″D	125		6.0, 35″W, 20″D
150	180	6.0, 30″W, 20″D	Available in NEMA Type 1 and Type 1 with gasket only			
200	245					

(1) Adding options may increase the space factor of the unit.

Bulletin 2162U - Combination PowerFlex 753 Variable Frequency AC Drive (VFD) with Fusible Disconnect (Normal Duty)

Nominal HP (kW)	480V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and Type 1 w/Gasket	NEMA Type 12
1	2.1	These ratings are currently only available in units designed for Heavy Duty applications. Heavy Duty unit designs can also be used for Normal Duty applications	
1.5	3.0		
2	3.4		
3	5.0		
5	8..0		
7.5	11		
10	14	2.5	2.5
15	22		3.0
20	27		3.5
25	34		
30	40	3.0	
40	52		4.0
50	65		

(1) Adding options may increase the space factor of the unit.

Bulletin 2162U - Combination PowerFlex 753 Variable Frequency AC Drive (VFD) with Fusible Disconnect (Heavy Duty)

Nominal HP (kW)	480V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and Type 1 w/Gasket	NEMA Type 12
1	2.1	2.5	2.5
1.5	3.0		
2	3.4		
3	5.0		
5	8..0		
7.5	11		
10	14		3.0
15	22		3.5
20	27		
25	34	3.0	
30	40		4.0
40	52		

(1) Adding options may increase the space factor of the unit.

Bulletin 2163U - Combination PowerFlex 753 Variable Frequency AC Drive (VFD) with Fusible Disconnect (Normal Duty)

Nominal HP (kW)	480V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and Type 1 w/Gasket	NEMA Type 12
1	2.1	These ratings are currently only available in units designed for Heavy Duty applications. Heavy Duty unit designs can also be used for Normal Duty applications	
1.5	3.0		
2	3.4		
3	5.0		
5	8..0		
7.5	11		
10	14	2.5	2.5
15	22		3.0
20	27		3.5
25	34		
30	40	3.0	
40	52		4.0
50	65		

(1) Adding options may increase the space factor of the unit.

Bulletin 2163U - Combination PowerFlex 753 Variable Frequency AC Drive (VFD) with Fusible Disconnect (Heavy Duty)

Nominal HP (kW)	480V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and Type 1 w/Gasket	NEMA Type 12
1	2.1	2.5	2.5
1.5	3.0		
2	3.4		
3	5.0		
5	8..0		
7.5	11		
10	14		3.0
15	22		3.5
20	27		
25	34	3.0	
30	40		4.0
40	52		

(1) Adding options may increase the space factor of the unit.

Manual Drive Bypass and PowerFlex 70 or PowerFlex 700 Drive - Bulletin 2164Q, 2164R, 2165Q and 2165R

These combination variable frequency drive units consist of two interlocked components, one containing the bypass circuitry and one containing a PowerFlex 70 (Bulletin 2164Q or 2165Q) or PowerFlex 700 (Bulletin 2164R or 2165R) variable frequency drive. The bypass component contains a fusible or circuit breaker disconnect, control circuit transformer, six-pole manually operated bypass switch, pull-apart terminal blocks and bypass contactor (Bulletin 100 contactor) with a Bulletin 193 overload relay. The drive compartment contains the respective PowerFlex variable frequency drive less control circuit transformer and disconnecting means. This configuration allows for the drive to be taken offline and replaced as needed with minimal disruption to the application process. When in bypass mode the serviceable drive component meets NFPA 70E hazard/Risk Level 0.

See page 74 for drive unit product descriptions and features.

The bypass component is provided as a NEMA Class II wiring, Type B unit. Terminals mounted on the drive chassis are provided for the connection of remote devices, input signals, etc. Also

- A Human Interface Module must be specified.
- 'Drive On' and 'Bypass On' pilot lights and HAND-OFF-AUTO selector switch, HAND START and HAND STOP push buttons must be specified.
- Control Platform Type (Bulletin 2164Q, 2165Q) or Control Interface Type (Bulletin 2164R, 2165R) must be specified for Bulletins 2164R and 2165R.

Bulletin 2164Q and 2165Q units use normal duty PowerFlex 70 drives.

Bulletin 2164R and 2165R units use normal duty PowerFlex 700 drives.

For all NEMA Type 3R and NEMA Type 4 applications, contact your local Rockwell Automation Sales Office or Allen-Bradley distributor.

Bulletin 2164Q - Combination PowerFlex 70 Variable Frequency AC Drive (VFD) with Fusible Disconnect and Manual, Isolated Bypass

Nominal Load HP(kW)	480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor(1)		Maximum Continuous Output Current (Amperes)	Space Factor(1)	
		NEMA Type 1 and 1 w/Gasket	NEMA Type 12		NEMA Type 1 and 1 w/Gasket	NEMA Type 12
0.5	1.1	2.5	3.0	0.9	2.5	3.0
0.75…1	2.1			1.7		
1.5…2	3.4			2.7		
3	5	3.0		3.9	3.0	
5	8			6.1		
7.5	11	3.5	3.5	9	3.5	3.5
10	14			11		
15	22		4.0	17		4.0
20	27		4.5	22		4.5

(1) Adding options may increase the space factor of the unit.

Bulletin 2165Q - Combination PowerFlex 70 Variable Frequency AC Drive (VFD) with Circuit Breaker Disconnect and Manual, Isolated Bypass

Nominal Load HP(kW)	480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/Gasket	NEMA Type 12		NEMA Type 1 and 1 w/Gasket	NEMA Type 12
0.5	1.1	2.5	3.0	0.9	2.5	3.0
0.75…1	2.1			1.7		
1.5…2	3.4			2.7		
3	5	3.0		3.9	3.0	
5	8			6.1		
7.5	11	3.5	3.5	9	3.5	3.5
10	14			11		
15	22		4.0	17		4.0
20	27		4.5	22		4.5

(1) Adding options may increase the space factor of the unit.

Bulletin 2164R - Combination PowerFlex 700 Variable Frequency AC Drive (VFD) with Fusible Disconnect and Manual, Isolated Bypass

Nominal Load HP(kW)	480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor[1]		Maximum Continuous Output Current (Amperes)	Space Factor[1]	
		NEMA Type 1 and 1 w/Gasket	NEMA Type 12		NEMA Type 1 and 1 w/Gasket	NEMA Type 12
0.5	1.1	3.0	3.0			
0.75…1	2.1			1.7	3.0	3.0
1.5…2	3.4			2.7		
3	5			3.9		
5	8	3.5	3.5	6.1	3.5	3.5
7.5	11			9		
10	14			11		
15	22		4.0	17		4.0
20	27			22		
25	34			27		
30	40	4.5	4.5	32	4.5	4.5
40	52	5.0	5.5	41	5.0	5.5
50	65	5.5	6.0	52		
60	77	6.0, 35″ W	6.0, 35″ W	62	6.0, 35″W	6.0, 35″W
75	96	6.0 35″ W, 20″ D	6.0 35″ W, 20″ D	77	6.0, 35″W, 20″D	6.0, 35″W, 20″D
100	125			125	6.0, 45″W, 20″D	6.0, 45″W, 20″D
125	156	6.0 45″ W, 20″ D	6.0 45″ W, 20″ D			
150	180		6.0 50″ W, 20″ D	144		6.0, 50″W, 20″D

(1) Adding options may increase the space factor of the unit.

Bulletin 2165R - Combination PowerFlex 700 Variable Frequency AC Drive (VFD) with Circuit Breaker Disconnect and Manual, Isolated Bypass

Nominal Load HP(kW)	480V			600V		
	Maximum Continuous Output Current (Amperes)	Space Factor(1)		Maximum Continuous Output Current (Amperes)	Space Factor(1)	
		NEMA Type 1 and 1 w/Gasket	NEMA Type 12		NEMA Type 1 and 1 w/Gasket	NEMA Type 12
0.5	1.1	3.0	3.0			
0.75…1	2.1			1.7	3.0	3.0
1.5…2	3.4			2.7		
3	5			3.9		
5	8	3.5	3.5	6.1	3.5	3.5
7.5	11			9		
10	14			11		
15	22		4.0	17		4.0
20	27			22		
25	34			27		
30	40	4.5	4.5	32	4.5	4.5
40	52	5.0	5.5	41	5.0	5.5
50	65	5.5	6.0	52		
60	77	6.0, 35″ W	6.0, 35″ W	62	6.0, 35″W	6.0, 35″W
75	96	6.0 35″ W, 20″ D	6.0 35″ W, 20″ D	77	6.0, 35″W, 20″D	6.0, 35″W, 20″D
100	125			125	6.0, 45″W, 20″D	6.0, 45″W, 20″D
125	156	6.0 45″ W, 20″ D	6.0 45″ W, 20″ D			
150	180		6.0 50″ W, 20″ D	144		6.0, 50″W, 20″D

(1) Adding options may increase the space factor of the unit.

PowerFlex 700H Variable Frequency AC Drive (VFD) Load Reactor

A load reactor (connecting a reactor on the load side of the drive) should be considered in the following situations:

- Multi-motor applications (one drive feeding more than one motor)
- A low voltage insulation class motor applied on a long cable length
- 575V motor applications (other than short cable length applications)

A load reactor is NOT required for applications where:

- Line voltage is 230V or less.
- A Bulletin 1204 terminator unit is utilized.
- An Allen-Bradley controlled matched solution is being applied (a 1850V CIV motor is used for a cable length of 600 ft. (185 m)or less in a 575V application).

Bulletin 2160R - PowerFlex 700H Variable Frequency AC Drive (VFD) Load Reactor

Drive Rating	Nominal Horsepower (1)	Line Voltage	Space Factor (2)	Space Factor	Catalog Number NEMA Type 12
Heavy Duty	150	480	1.5	Available for NEMA Type 1 and Type 1 w/ gasket only	
	200	480			
Normal Duty	200	480			

(1) The horsepower ratings shown are nominal.
(2) Adding options may increase the space factor of the unit.

Variable Frequency Drives Unit Options

These tables provide information on the options available for Drives units.

Optional Equipment for Variable Frequency Drives Units

Option	Description		PowerFlex 40, 70 and 700 Drives		PowerFlex 753 Drives	PowerFlex 70 and 700 Manual Drive Bypass	
			2162Q 2162R 2163Q 2163R	2162T 2163T	2162U 2163U	2164Q 2164R.	2165Q 2165R
Push Buttons	Drive Start–Drive Stop		✓	✓			
	Jog		✓				
Push Buttons and Selector Switch	Hand-Off-Auto, Hand Start-Hand Stop					✓	✓
Selector Switch	Auto–Manual (speed select)		✓	✓			
	Forward–Reverse		✓				
	Hand–Off–Auto		✓	✓	✓		
Pilot Lights (Transformer Type for 800T, full voltage 800F)	Standard type	Run	✓	✓	✓		
		Run-At Speed	✓		✓		
		Fault			✓		
		Bypass On-Drive On				✓	✓
	LED type	Run	✓	✓	✓		
		Run-At Speed	✓		✓		
		Fault			✓		
		Bypass On-Drive On				✓	✓
	Push-to-Test standard type	Run	✓	✓	✓		
		Run–At Speed	✓		✓		
		Fault			✓		
		Bypass On-Drive On				✓	✓
	Push-to-Test LED type	Run	✓	✓	✓		
		Run-At Speed	✓		✓		
		Fault			✓		
		Bypass On-Drive On				✓	✓

Communication Modules for Drives Units

Option	Description	PowerFlex 40, 70 and 700 Drives		PowerFlex 753 Drives	PowerFlex 70 and 700 Manual Drive Bypass	
		2162Q 2163Q 2162R 2163R	2162T 2163T	2162U 2163U	2164Q 2164R	2165Q 2165R
Communication Module	ControlNet Communication Module, Mounted Internal to Drive. Includes one 1786-TPYS tap, supplied loose for customer mounting	✓	✓	✓	✓	✓
	DeviceNet communication module, mounted internal to drive	✓	✓	✓	✓	✓
	Ethernet communication module. Mounted internal to drive	✓	✓	✓	✓	✓
	Remote I/O communication module, mounted internal to drive	✓			✓	✓
	DeviceNet starter auxiliary module with four 120V AC inputs, two 120V AC outputs for drive bypass				✓	✓
	DeviceNet starter auxiliary module with four 24V DC inputs and two 24V DC outputs for drive bypass				✓	✓

Human Interface Module (HIM) (mutually exclusive) for Drives Units

Description		PowerFlex 40, 70 and 700 Drives		PowerFlex 753 Drives	PowerFlex 70 and 700 Manual Drive Bypass	
		2162Q 2163Q 2162R 2163R	2162T 2163T	2162U 2163U	2164Q 2164R	2165Q 2165R
No HIM (blank plate)	Mounted in bezel on the door. HIM is removable. NEMA 1, 1G only. Cable to drive is included.	✓	✓	✓	✓	✓
LCD display, full numeric keypad		✓	✓	✓	✓	✓
LCD display, programmer only		✓			✓	✓
No HIM (blank plate)	Mounted inside unit on drive. Available on NEMA Type 1, 1 with gasket and 12. Includes viewing window on door.	✓		✓	✓	✓
LCD display, full numeric keypad		✓		✓	✓	✓
LCD display, programmer only		✓			✓	✓
LCD display, digital keypad	Door mounted. HIM is not removable. Cable to drive is included. NEMA Type 12 Only.		✓			
LCD display, full numeric keypad		✓		✓	✓	✓
LCD display, programmer only		✓			✓	✓
LCD display, wireless interface module	Mounted in bezel on the door, HIM is removable. NEMA Type 1, 1G only.			✓		
	Door mounted. HIM is not removable. NEMA Type 12 only.			✓		

Optional Equipment for Variable Frequency Drives Units

Option	Description	PowerFlex 40, 70 and 700 Drives			PowerFlex 753 Drives	PowerFlex 70 and 700 Manual Drive Bypass	
		2162Q 2163Q	2162R 2163R	2162T 2163T	2162U 2163U	2164Q 2165Q	2164R 2165R
Encoder Feedback	Encoder Feedback Module, 12V		✓		✓		✓
	Dual Encoder Feedback Module, 12V				✓		
I/O Control Interface Type	24V DC Control Voltage Interface with Vector Control		✓				✓
	120V AC Control Voltage Interface with Vector Control		✓				✓
	24V DC Control Voltage with Sensorless Vector Control		✓				
	120V AC Control Voltage with Sensorless Vector Control		✓				
	Digital and Analog I/O option board, 24V DC control voltage inputs. Provides six digital inputs, two digital (Form -C) relay outputs, two analog inputs, two analog outputs.				✓		
	Digital and Analog I/O option board, 120V AC control voltage inputs. Provides six digital inputs, two digital (Form -C) relay outputs, two analog inputs, two analog outputs.				✓		
Enhanced Control Platform Type	Enhanced control for PowerFlex 70 drive units	✓				✓	
	Enhanced control for PowerFlex 70 drive units with DriveGuard Safe-off Option	✓				✓	
Analog Output Isolation	Provides a DC signal that is proportional to the drive DC output signal. The signal is fully isolated from the drive output, line power and ground.	✓	✓	✓		✓	✓
Ungrounded Power System	This option disconnects internal drive protective devices which are referenced to ground. This option is required if the drive will be used on an ungrounded power system or a power system which is grounded through any impedance.	✓	✓	✓	✓	✓	✓
Drive Safety (PowerFlex 750 Series)	Safe Torque-off with factory installed MSR138DP safety relay				✓		
	Safe Torque-off, requires customer supplied safety relay installed remotely from MCC drive unit				✓		
	Safe Speed Monitor (with integrated safety relay)				✓		
Drive Input Fusing (factory installed)	Gould 'AJT' UL Class J fuse				✓		
	Bussman 'LPJ' UL Class J fuse				✓		
Thermostat Control of Door Mounted Cooling Fans	Factory set for 35 °C				✓		

Line and Load Reactors for Drives Units

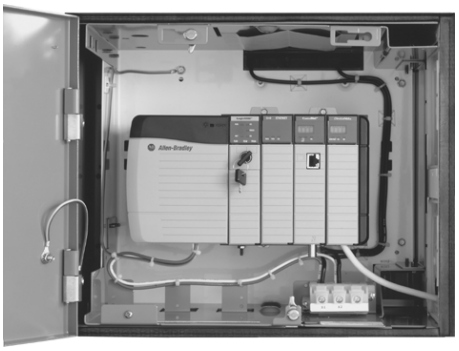
Option	Description			PowerFlex 40, 70 and 700 Drives		PowerFlex 753 Drives	PowerFlex 70 and 700 Manual Drive Bypass	
				2162Q 2162R 2162T	2163Q 2163R 2163T	2162U 2163U	2164Q 2164R	2165Q 2165R
Line or Load Reactors	3% impedance line or load reactor.	480V	0.5…1 HP	✓	✓	✓	✓	✓
			1.5…2 HP	✓	✓	✓	✓	✓
			3…5 HP	✓	✓	✓	✓	✓
			7.5 HP	✓	✓	✓	✓	✓
			10 HP	✓	✓	✓	✓	✓
			15 HP	✓	✓	✓	✓	✓
			20…25 HP	✓	✓	✓	✓	✓
			30 HP	✓	✓	✓	✓	✓
			40 HP	✓	✓	✓	✓	✓
			50…60 HP	✓	✓	✓	✓	✓
			75 HP	✓	✓		✓	✓
			100 HP	✓	✓		✓	✓
			125 HP	✓	✓		✓	✓
			150 HP	✓	✓		✓	✓
		600V	1 HP	✓	✓		✓	✓
			2 HP	✓	✓		✓	✓
			3…7.5 HP	✓	✓		✓	✓
			10 HP	✓	✓		✓	✓
			15 HP	✓	✓		✓	✓
			20…25 HP	✓	✓		✓	✓
			30 HP	✓	✓		✓	✓
			40 HP	✓	✓		✓	✓
			50…60 HP	✓	✓		✓	✓
			75 HP	✓	✓		✓	✓
			100 HP	✓	✓		✓	✓
			125 HP	✓	✓		✓	✓
			150 HP	✓	✓		✓	✓
Load Reactor Only	3% impedance load reactor for size code 300, Bulletin 2162R and 2163R drive units	480V	150HP 200 HP	✓	✓			

CENTERLINE 2100 Options for Drives Units

Option	Description		PowerFlex 40, 70 and 700 Drives		PowerFlex 753 Drives	PowerFlex 70 and 700 Manual Drive Bypass	
			2162Q 2162R 2162T	2163Q 2163R 2163T	2162U 2163U	2164Q 2164R	2165Q 2165R
Separate Control Fuse	Fuse (10 A) for customer supplied separate control source, 120V AC only.				✓		
Grounded Unit Door	Hinge mounted ground strap mounted on hinge of unit door. Unit door grounding strap for IEC requirements.		✓	✓	✓	✓	✓
Unit Load Connector	Specify on plug-in units for sections with unplated vertical unit load ground bus	Unplated copper	✓	✓	✓	✓	✓
	Specify on plug-in units for sections with tin plated vertical unit load ground bus	Tin plated cooper	✓	✓	✓	✓	✓
Unit Ground Stab	Specify on plug-in units for sections with vertical plug-in ground bus. Unplated copper unit ground stab can also be used with steel vertical ground bus.	Copper alloy	✓	✓	✓	✓	✓
		Unplated copper	✓	✓	✓	✓	✓
		Tin plated cooper	✓	✓	✓	✓	✓
Auxiliary Contacts	One Normally Open mounted on operating mechanism (operates with movement of external handle only)		✓	✓	✓	✓	✓
	One Normally Open mounted internally. Circuit breaker units only.		✓	✓	✓	✓	✓
	One Normally Closed mounted on operating mechanism (operates with movement of external handle only)		✓	✓	✓	✓	✓
	One Normally Closed mounted internally. Circuit breaker units only.		✓	✓	✓	✓	✓
T-Handle	T-Handle latch on unit door.		✓	✓	✓	✓	✓
Control Circuit Wiring	Type MTW (TEW) 90 °C #16 AWG copper wire, VW1 rated, provided as standard		✓	✓	✓	✓	✓
Control Wire Markers	Brady Datab wire markers at each end of the control wires.		✓	✓	✓	✓	✓
	Heat shrink type wire markers		✓	✓	✓	✓	✓
	Sleeve type wire marker		✓	✓	✓	✓	✓
French Legend Plates	Legend plates printed in French are available on all pilot devices.		✓	✓	✓	✓	✓
Spanish Legend Plates	Legend plates printed in Spanish are available on all pilot devices.		✓	✓	✓	✓	✓
Unit Door Nameplates	Door Nameplate Screws	Plated steel nameplate screws. Provided when cardholder or nameplates are not selected.	✓	✓	✓	✓	✓
	Card Holder for Unit Doors	1.125" x 3.625" plastic card holders with blank cards	✓	✓	✓	✓	✓
	1.125″ x 3.625″ engraved 3-line nameplate or 4-line nameplate	Acrylic plate. Nameplate is white with black letters or black with white letters.	✓	✓	✓	✓	✓
		Phenolic plate. Nameplate is white with black letters or black with white letters.	✓	✓	✓	✓	✓
Stainless Steel Nameplate Screws	Stainless steel nameplate screws for unit nameplates (2 per unit)		✓	✓	✓	✓	✓
Export Packing Below Deck	Container is skid mounted and packaged in clear plastic. Packing is not watertight or waterproof. Extended storage may require space heater and other considerations.		✓	✓	✓	✓	✓

Notes:

Programmable Automation Controller Units



ControlLogix Chassis (1756) - Bulletin 2180L, 2182L, 2183L

The Bulletin 2180L, 2182L and 2183L units include a choice of one 4-slot or one 7-slot Bulletin 1756 ControlLogix chassis.

Unit features:

Without disconnecting means or plug-in stabs:

•4-slot chassis, 1.0 space factor.

•7-slot chassis, 2.0 space factor (frame mounted unit, section does not have vertical wireway next to this unit). Bottom mounted only.

With disconnecting means:

- Fusible disconnect (30 A switch), plug-in stabs, control circuit transformer, 4-slot chassis, 1.5 space factor.
- Fusible disconnect (30 A switch) without plug-in stabs, control circuit transformer, 7-slot chassis, 2.0 space factor (frame mounted unit, section does not have vertical wireway next to this unit). Bottom mounted only.
- Circuit breaker (15 A trip), plug-in stabs, control circuit transformer, 4-slot chassis, 1.5 space factor.
- Circuit breaker (15 A trip) without plug-in stabs, control circuit transformer, 7-slot chassis, 2.0 space factor (frame mounted unit, section does not have vertical wireway next to this unit). Bottom mounted only.

Unit options include:

- Processor cards (all memory upgrade options).
- Communication cards (Ethernet, ControlNet, DeviceNet, RI/O, DH+).
- Power supply (10.0 A)

Bulletin 2180L, 2182L, 2183L ControlLogix Programmable Controller (PLC)

Bulletin	I/O Chassis		Space Factor(1)
	Chassis Quantity	Chassis Size	
2180L Basic I/O chassis without disconnecting means or plug-in stabs. Includes viewing window.	1	4 slot	1.0
	1	7 slot	2.0
2182L Basic I/O chassis with disconnect and transformer. Includes viewing window.	1	4 slot	1.5
	1	7 slot	2.0
2183L Basic I/O chassis with circuit breaker and transformer. Includes viewing window.	1	4 slot	1.5
	1	7 slot	2.0

(1) Adding options may increase the space factor of the unit.

PLC Unit Options

These tables provide information on the options available for PLC units.

Controller Options for PLC Units

Option	Description		Bulletin 1756 ControlLogix Chassis		
			2180L	2182L	2183L
Power Supply	Bulletin 1756-PA72, 10.0 A power supply for 4- and 7-slot ControlLogix chassis		✓	✓	✓
ControlLogix Processor	Logix5561 Processor With 2 Mbyte Memory, includes 1784-CF64 64 Mbyte CompactFlash memory module		✓	✓	✓
	Logix5562 Processor With 4Mbyte Memory, includes 1784-CF64 64 Mbyte CompactFlash memory module		✓	✓	✓
	Logix5563 Processor With 8Mbyte Memory, includes 1784-CF64 64Mbyte CompactFlash memory module		✓	✓	✓
	Logix5564 Processor With 16 Mbyte Memory, includes 1784-CF64 64 Mbyte CompactFlash memory module		✓	✓	✓
ControlLogix Communication Modules	Bulletin 1756-CNBR ControlNet communication module with redundant ControlNet port		✓	✓	✓
	Bulletin 1756-ENBT Ethernet communication module		✓	✓	✓
	Bulletin 1756-DNB DeviceNet communication module		✓	✓	✓
	Bulletin 1756-DHRIO Data Highway Plus and Remote I/O communication module		✓	✓	✓
ControlLogix Programming Cable	Bulletin 1756-CP3 cable for programming ControlLogix processors		✓	✓	✓
ControlNet T-Tap	Bulletin 1786 ControlNet T-Tap for use with ControlNet Communication Modules		✓	✓	✓
Grounded Unit Door	Hinge mounted ground strap mounted on hinge of unit door. (Unit door grounding strap for IEC requirements.)		✓	✓	✓
Unit Ground Stab	Select on plug-in units for sections with vertical plug-in ground bus. Unplated copper unit ground stab can also be used with steel vertical ground bus.	Copper alloy	✓	✓	✓
		Unplated copper	✓	✓	✓
		Tin plate copper	✓	✓	✓
Auxiliary Contacts	One Normally Open contact mounted on operating mechanism (operates with movement of external handle only)	Disconnects		✓	
		Circuit Breakers			✓
	One Normally Open contact mounted internally	Circuit Breakers			✓
	One Normally Closed contact mounted on operating mechanism (operates with movement of external handle only)	Disconnects		✓	
		Circuit Breakers			✓
	One Normally Closed contact mounted internally	Circuit Breakers			✓

CENTERLINE 2100 Options for PLC Units

Option	Description		Bulletin 1756 ControlLogix Chassis		
			2180L	2182L	2183L
T-Handle	T-Handle latches on unit door		✓	✓	✓
Control Wire Markers	Adhesive Brady Datab type markers at each end of control wire. Not available in Canada.			✓	✓
	Heat shrink type wire marker			✓	✓
	Sleeve type wire marker			✓	✓
Unit Door Nameplate	Door Nameplate Screws	Plated steel nameplate screws. Provided when cardholder or nameplates are not selected.	✓	✓	✓
	Card Holder for Unit Doors	1.125" x 3.625" plastic card holders with blank cards	✓	✓	✓
	1.125″ x 3.625″ engraved three-line nameplate or four-line nameplate	Acrylic plate (available in U.S. only). Lettering is white with black letters or black with white letters.	✓	✓	✓
		Phenolic plate. Lettering is white with black letters or black with white letters.	✓	✓	✓
Stainless Steel Nameplate Screws	Stainless steel nameplate screws for unit nameplate (two per unit)		✓	✓	✓
Export Packing Below Deck	Container is skid mounted and packaged in clear plastic. Packing is not watertight or waterproof. Considerations should be taken if extended storage is expected.		✓	✓	✓

Technical Standards and Certifications

UL/cUL/CSA Marking

CENTERLINE 2100 Motor Control Centers are listed by Underwriters Laboratories, Inc. (file number E49289) as complying with Standard Safety UL 845 (UL) and either listed by Underwriters Laboratories, Inc. or certified by Canadian Standards Association (CSA) as complying with standard C22-2, No. 254-05 (cUL or CSA). CENTERLINE 2100 MCCs also meet the requirements in Mexican standard for MCCs, NMXJ-353-ANCE-2006. The MCC product, sections and units will therefore carry the respective marking unless otherwise indicated in the footnotes on the various pages in this publication.

ISO 9001 Certification

The facilities that develop and manufacture CENTERLINE 2100 MCCs are located in Milwaukee and Richland Center, Wisconsin, Cambridge, Ontario, Canada, Tecate, Mexico and Guadalupe, Mexico. All facilities have been certified to be in conformance to the requirements of Quality Management System ISO 9001. These facilities presently are certified by Det Norske Veritas to ISO 9001: 2000, certificate number CERT-9379-2004-AQ-HOU ANAB, effective May 30, 2007.

CE Marking

The European Union (EU) has established a program whereby products are tested and qualified to meet its harmonized standards and to fulfill the EN Directives. Upon completion of this testing and qualification, special documentation is required so the products may bear CE marking. Included with this program is the requirement for special instruction literature, product labeling, quality programs, and special design requirements. Generally, the CENTERLINE 2100 MCC product can fulfill these requirements, but due to the customization that is required, the CE marking of the product is available only on the Engineered delivery program. In case of variable frequency drives (as well as other solid-state devices), the EU deemed it necessary to add an EMC directive (2004/108/EC). This directive requires more stringent RF emission and immunity standards than normal. To meet these requirements and carry the CE mark, the CENTERLINE 2100 drive packages can be adapted with EMC tested RFI filters and additional shielding hardware. These special packages may require larger MCC enclosures. Note: The CE requirement is for the European Union/Community and is not a mandate for other parts of the world.

For more information about product certification, visit http://www.rockwellautomation.com/products/certification/

IEC 60439

The CENTERLINE 2100 structures and many units fulfill IEC 60439 type tested assembly (TTA) and unit requirements. Should custom designs and modifications be required, these can be qualified to IEC 60439 as partially pre-tested assembly (PTTA) and unit requirements.

American Bureau of Shipping (ABS)

CENTERLINE 2100 MCCs have fulfilled the requirements and are approved by the American Bureau of Shipping (certificate 99-SB55875-X). CENTERLINE 2100 MCCs do meet ABS shipping requirements, but due to required customization, ABS maritime shipping is available only on the Engineered program.

NEMA Class

NEMA—National Electrical Manufacturers Association.

The following is a description of Class I, as paraphrased from NEMA standard ICS 18-2001: Class I motor control centers shall consist of mechanical groupings of combination motor control units, feeder tap units, other units and electrical devices arranged in a convenient assembly. They include connections from the common horizontal power bus to the units. They do not include interwiring or interlocking between units or to remotely mounted devices, nor do they include control system engineering. Only diagrams of the individual units are supplied.

NEMA Class II interwiring offers the addition of interlocking and wiring between units as specifically described in overall control system diagrams supplied by the purchaser. Contact your local Rockwell Automation Sales Office for availability.

NEMA Type

Class I motor control centers can be provided in NEMA Type A or B construction:

- Type A—User's power and control connections are made directly to the device within the unit.
- Type B—Terminal blocks are supplied for user's control termination within unit insert. On NEMA size 1 through 3 starter units and 30…100 A contactors units, terminal blocks are also supplied for user's load terminations (NEMA Type BT). NEMA Space Saving units do not include power terminal blocks (NEMA Type BD).

NEMA/IEC Enclosure Comparison

The following table is a comparison of Allen-Bradley CENTERLINE 2100 MCC NEMA enclosure type numbers to IEC Standard 60529, Classification of Degrees of Protection Provided by Enclosures. The comparison is based on data from tests conducted on the CENTERLINE 2100 MCC enclosures and the NEMA enclosure type test requirements, which meet or exceed the IEC enclosure classification designation test requirements

NEMA Type 1 vented (with or without gasketed doors)	IP20
NEMA Type 1 vented with filters (with or without gasketed doors)	IP30
NEMA Type 1 non-vented (without gasketed doors)	IP40
NEMA Type 1 with drip hood = NEMA Type 2 (with or without gasketed doors)	IP41
NEMA Type 3R	IP44
NEMA Type 12 without bottom plates	IP53
NEMA Type 12 with bottom plates	IP54
NEMA Type 4	IP65

NEMA Enclosure Type Descriptions

- NEMA Type 1 - Type 1 units and sections are intended for indoor use, primarily to provide a degree of protection against contact with the enclosed equipment in locations where unusual service conditions do not exist. The enclosures are designed to meet the rod entry and rust resistance design tests. The enclosure is sheet steel, treated to resist corrosion.
- NEMA Type 1 with gasketed doors (sometimes referred to as 1G) - Type 1 with gasketed unit doors are completely gasketed around the perimeter of the unit doors. All gasketing is closed cell neoprene.
- NEMA Type 12[(1)] - Type 12 enclosures are intended for indoor use, primarily to provide a degree of protection against dust, falling dirt and non-corrosive dripping liquids. They are designed to meet drip, dust and rust resistance tests. They are not intended to provide protection against conditions such as internal condensation.
- NEMA Type 3R - Non-walk-in front mounted only. Door-within-a-door construction. Type 3R units and sections are intended for outdoor use, primarily to provide a degree of protection against falling rain and to avoid damage from the formation of ice on the enclosure. They are designed to meet rod entry, rain, external icing and rust resistance design tests. They are not intended to provide protection against conditions such as dust, internal condensation or internal icing.
- NEMA Type 4 - Non-walk-in front mounted only. Door-within-a-door construction. Type 4 units and sections are designed for indoor and outdoor use, primarily to provide protection against windblown dust and rain, splashing water and hose-directed water. They are also designed to remain undamaged by the formation of ice on the enclosure. They are designed to meet hosedown, external icing, rod entry and rust-resistance design tests. The enclosures are not designed to protect against internal condensation or internal icing.

Seismic Applications

CENTERLINE 2100 MCCs meet the requirements for Uniform Building Code (UBC) Zone 4 seismic applications and comply with IBC 2000 & 2006 seismic criteria.

Actual CENTERLINE 2100 Motor Control Center (MCC) samples have been seismically qualified by dynamic (triaxial multi-frequency testing) seismic tests per IEEE 344 Seismic Test Standards. The results of this MCC seismic testing demonstrated compliance with the 100% g level of Uniform Building Code 1997 (UBC) Zone 4 (the maximum UBC Zone) and 100% g level of the International Building Code 2006 (IBC), that is, the MCC structure, the MCC units, the MCC components or electrical functions were not compromised when subjected to a UBC Zone 4 earthquake or the IBC seismic event. Per the IEEE 344 Standard, the equipment was under power and operated before, during and after the seismic tests.

To obtain a UBC or IBC seismic withstandability, each individual CENTERLINE 2100 MCC line-up (for example, both front and back MCCs in 'back-to-back' applications) must be mounted on an adequate seismic foundation and installed per the seismic anchoring requirements as indicated in publication 2100-IN012, CENTERLINE 2100 Motor Control Centers User Manual.

Note: Variable frequency drive units utilizing 'rollout' drive configurations are not seismically certified.

(1) This publication refers to standard NEMA Type 12 design (that is, standard sheet steel). For stainless steel NEMA Type 12 enclosures, contact your local Rockwell Automation Sales Office.

Motor Applications

The Motor Control Center Business has made engineering evaluations for the protective device (circuit breaker or fuse) selection, sizing and setting range based on the protection rules/requirements and motor criteria as stipulated in NEC, NEMA and UL standards (for example, motor full load currents [FLCs], X/R ratios, lock rotor currents, and nominal utilization voltages). Should the motor application have criteria that deviate from those stated in the aforementioned standards, higher FLC and/or motor inrush currents (greater than 1300% of the nominal FLC) may be experienced (for example, special motors, non-standard NEMA motors, energy efficient motors, Design E motors, and IEC Type N motors).

Additional Resources

For assembled motor control centers, the customer is supplied with a copy of the motor control center layout and specification (Form 385) and the CENTERLINE 2100 Motor Control Centers User Manual, publication 2100-IN012. The Receiving, Handling and Storing Motor Control Centers Instructions, publication 2100-IN040, is attached to the outside packaging of each shipping block.

Up to three electronic documentation CDs can be also be provided at no additional cost for each MCC. The CD contains the following:

- Equipment list (elevation, layout specification) drawings
- One-line diagrams (if requested)
- Unit wiring diagrams
- Spare parts list
- User and installation manuals for Rockwell Automation products, supplied in the specific motor control center
- Test reporting

For other documentation, contact your local Rockwell Automation Sales Office.

Additional CENTERLINE 2100 Motor Control Centers Publications

Publication	Title
2100-SR012	CENTERLINE 2100 MCC Specification Guide
2100-SR003	CENTERLINE 2100 MCC Specification Checklist
2100-4.2	Mains and Incoming Lines Dimension
2100-IN012	CENTERLINE 2100 User Manual
2100-6.0.2	Renewal Parts Publication
2100-AT003	Power System Configuration Considerations for Selection of CENTERLINE 2100 MCCs
2100-SR008	DeviceNet Specification Guide
2100-TD019	DeviceNet Hardware Manual
2100-AT002	Arc-Flash Protection Marking Guide for CENTERLINE Motor Control Center
2100-AP003	Arc-Flash Resistant Low Voltage Motor Control Center Designs
2100-TD001	CENTERLINE 2100 MCCs Instantaneous Trip Motor Circuit Protectors (HMCP)
2100-TD002	Inverse Time Motor Circuit Protectors for CENTERLINE 2100 MCCs
2100-TD003	CENTERLINE MCC Power Fuses

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Publication 2100-SG003A-EN-P – September 2010

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